

U.S. RE-ENGAGEMENT IN THE GLOBAL EFFORT TO FIGHT CLIMATE CHANGE

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U.S. RE-ENGAGEMENT IN THE GLOBAL EFFORT TO FIGHT CLIMATE CHANGE

TUESDAY, MAY 15, 2007

HOUSE OF REPRESENTATIVES,
COMMITTEE ON FOREIGN AFFAIRS,
Washington, DC.

The committee met, pursuant to notice, at 10:03 a.m. in room 2172, Rayburn House Office Building, Hon. Tom Lantos (chairman of the committee) presiding.

Chairman LANTOS. Committee will come to order. We are not here today to debate the existence of global warming. There will be no dueling charts and graphs. There will be no recitation of scientific arguments that point first one way, then the other like a weathervane gone wild. The time for that is over. That debate is done.

The question now is what are we going to do about the global warming crisis in a concrete, far-reaching way, in a way that will create a truly livable world for my 17 grandchildren and for all others? So today I have an announcement. On May 23, I will bring serious substantive legislation before our committee to reinvigorate international negotiations to stop global warming and to help developing nations produce energy in a clean and sustainable way.

With passage of the bill, this committee and this Congress will send a strong bipartisan signal that the time for endless delays to stem global warming is past. Task number one is to overhaul dramatically the manner in which this administration and the administration that follows it negotiates with our global partners on climate change. Like the last remaining fan at a sporting event whose team is losing badly, this administration has stubbornly sat on its hands and refused to acknowledge the score.

It has dispatched low level negotiators to international climate meetings armed with simple marching orders: Deny, stall and postpone. Just the other day, the *Washington Post* revealed that the administration is trying to soften tough climate change language to be declared at next month's G-8 meeting. Under my legislation, cabinet level officials will board planes to represent the United States at critical climate change negotiations. Instead of turning their backs on the United Nations, our diplomats will negotiate intensively within the global framework.

And if the White House heeds the call of my bill, our diplomats will have a bold, new mission to negotiate a post Kyoto framework that contains binding commitments for environmental action from all of the world's polluters, including China and India. As my legislation makes clear, any meaningful post Kyoto agreement must

have three key elements: A viable target for stabilizing carbon dioxide concentration in the earth's atmosphere, binding emissions reduction targets, and flexible mechanisms such as carbon trading to make the agreement economically workable.

But given the potentially catastrophic humanitarian consequences of global warming, we cannot wait for the years it will take for such an agreement to be done before we roll up our sleeves and start working. That is why my bill allocates more money to the U.S. Agency for International Development to work with developing nations to improve energy efficiency and to bolster the regulatory and financial environment for adopting clean energy technologies.

That is why my legislation contains new initiatives to boost American exports of energy efficient and clean energy technologies, a sector of our economy on the cutting edge of technological innovation, and that is why I propose the establishment of an international clean energy foundation, a semiautonomous institution that would leverage the resources that NGOs, private companies, foreign governments can bring to bear. The foundation will support the most creative and feasible models for implementing renewable energy sources and other energy alternatives.

The good news is that because of the hard work of scientists, innovators and entrepreneurs around the globe the technology we need to stem global warming is available and is affordable but to summon the national and global political will to tackle climate change we need to adopt collectively a new mindset about our planet, an urgent proactive mindset.

Speaker Nancy Pelosi, to her enormous credit, has challenged all committees to submit legislation by June. We, in our committee, will fill this most important mandate, and Congress will at long last approve far-reaching legislation to revive American leadership worldwide in efforts to curb global warming and to preserve our planet for future generations. I now invite my dear friend and distinguished colleague, the ranking member of the committee, Ileana Ros-Lehtinen, and to make any remarks she may choose.

Ms. ROS-LEHTINEN. Thank you so much, Mr. Chairman. Thank you for your leadership as always, and I join you in welcoming our witnesses here this morning, and thank them for the time that they will spend with us today. Regardless of what we think the causes of global warming may be, we do need to consider how any manmade contributions to that trend might best be addressed. Some argue that it is time for the United States to agree to cut its emissions under an international agreement. Some would support a central planning approach involving orders to industries to make specific quantifiable cuts in emissions, perhaps regardless of the impacts on the economy.

Others would support the use of some sort of market mechanism in that central planning system to place a cost on the emissions of such gasses that would provide an incentive for industries to cut them. Still others would place an outright tax on those emissions to ensure that the cost involved provides a direct incentive to cut them and then leave it to industry to make the cuts in the emissions necessary.

Other proposals point to what proponents see as current and likely future failings in the present international efforts to cut emissions which the U.S. is not yet a part of. Still others believe that the rapid development of new technologies is the best way to go and warn that an international approach has to take into account the behavior and interest of individual countries.

Essentially they argue that governments will not fulfill commitments that tend to hurt their economies and reduce job opportunities. Controls or caps on each country's emissions of gasses that may cause warming of the climate appear to be the approach that many in the environmental community favor. Some experts reviewing that approach, however, raise concerns about merely ordering cuts in emissions without consideration of the economic impact they might have including on job creation.

For example, it appears that the extent to which the states of the European Union have been able to cap their emissions so far has been determined by their ability to tap into the unused emissions quota available that the states of the former Soviet Union have available only because those states' emissions fell significantly in the years following the breakup of the Soviet Union and the economic decline that followed.

We are already seeing some examples in which factories in Europe that are trying to cut their emissions are in jeopardy of going out of business or cutting their workforce or hours on the job. Other experts have been focusing on new technologies as the silver bullet solution to global warming. We should be encouraging further research and development in the relevant technologies whether they relate to wind, solar or nuclear or fossil fuel generation, and with regard to new technologies, I am interested in hearing the view of our panelists concerning the most recent research into carbon capture technology, and whether it is as promising as it sounds.

And finally, Mr. Chairman, it is doubtful that we can achieve anything in this endeavor if we do not have the cooperation of countries that have fast growing economies, such as China and India. They are rapidly becoming the leading sources of emissions of so-called greenhouse gasses, and here I would like to raise the view that many have, a general caution about where international agreements can lead us.

As I have noted, some have raised the need to turn to the creation of international agreements for a solution. However, as we have seen across a number of sectors including most recently on issues relating to proliferation and human rights, seeking consensus through such international agreements can often translate into a race to the bottom or the lowest common denominator outcomes and such agreements will also raise concerns about possibly surrendering U.S. sovereignty to international mechanisms that could easily be manipulated to serve as anti-U.S. or anti-developed world agenda.

And finally, Mr. Chairman, you have proposed legislation on the issue of climate change, and we received that text late last Friday, and today's hearing is the only hearing that perhaps this committee may have on this issue, and you may ask to markup that legislation in the committee next week. I have asked for additional

full committee and subcommittee hearings, Mr. Chairman, to be held on the subject matter before scheduling the legislation for markup so that all the members can have an opportunity for a careful review.

Some of the proposals in your bill, Mr. Chairman, include a statement of congressional policy that the United States will work on emission cuts for itself and other countries under the United Nations Framework Convention on Climate Control, the convention to which the Kyoto protocol is now attached, as you mention in your statement.

Also in the bill is the creation of the State Department office on global climate change and the authorization of \$1 billion over 5 years for assistance through AID to promote clean and efficient energy technologies in other countries, and the creation of an international clean energy foundation that will be supported with \$100 million in U.S. Government funds over 5 years, and we ask our distinguished panelists to address some of these proposals, and again hope that we will have further opportunities, Mr. Chairman, for review before we enter into consideration of this or other related bills. So I thank the gentleman for the time.

Chairman LANTOS. I thank very much my friend. Any member who would like to make an opening statement please indicate. Mr. Rohrabacher.

Mr. ROHRABACHER. Thank you very much, Mr. Chairman. We have been going now almost a half a year, and every time we have a hearing I say how much I agree with the chairman because it is a miracle because I am a very conservative Republican and the chairman obviously is of the other party. Let me just note that at last we find something where we disagree, Mr. Chairman. In every other hearing that we have had, I have just been applauding the chair.

Chairman LANTOS. I already feel better.

Mr. ROHRABACHER. So let me just note that I have a major disagreement with you on this issue. I would like to submit for the record several articles. One here by MIT Professor Richard Lindzen from *Newsweek* which has many criticisms of those people who are trying to frighten the world into actions that are counterproductive over the so-called global warming.

Mr. Chairman, there is no doubt and there are many quotes that we have here—and also I would submit for the record an article by the same *Newsweek* magazine that talks about consistency with people who are suggesting that we have to move forward with global warming and how there has been one report that suggests we cut down all the trees in order to combat global warming, which of course represents the type of hysteria that will lead us in the wrong direction.

Chairman LANTOS. Without objection.

[The information referred to follows:]

MORE TREES, LESS GLOBAL WARMING, RIGHT?—NOT EXACTLY

A 150-YEAR SIMULATION OF WORLDWIDE DEFORESTATION FINDS THAT TROPICAL FORESTS ARE CARBON SINKS AND BOREAL FORESTS CONTRIBUTE TO WARMING

April 10, 2007

Before compact fluorescent light bulbs and ethanol, the first line of defense against global warming was planting trees.

Forests, after all, cool the atmosphere by drinking in carbon dioxide from the air. A new study, however, published in *Proceedings of the National Academy of Sciences* reports that forests' other climatic effects can cancel out their carbon cleaning advantage in some parts of the world. Using a three-dimensional climate model, the research team mimicked full global deforestation and also studied the effects of clear-cutting in different regions of latitude, such as the tropics and boreal zones. Apparently, these natural carbon sinks only do their job effectively in tropical regions; in other areas, they have either no impact or actually contribute to warming the planet. In fact, according to this model, by the year 2100, if all the forests were cut and left to rot, the annual global mean temperature would *decrease* by more than 0.5 degree Fahrenheit.

"I'm not sure the slight amount of cooling is necessarily significant, but that removing all the forest produced little change" on temperature is, says study co-author Ken Caldeira, an ecologist at the Carnegie Institution of Washington's Department of Global Ecology in Stanford, Calif. "I think what's interesting is this global cancellation was a product of very different responses at different latitudes."

Trees perform three major climate functions: They absorb carbon, which they pull from the atmosphere, creating a cooling effect; their dark green leaves absorb light from the sun, heating Earth's surface; and they draw water from the soil, which evaporates into the atmosphere, creating low clouds that reflect the sun's hot rays (a mechanism known as evotranspiration that also leads to cooling). These three factors—the second two being largely ignored in climate models up to this point, according to Caldeira—taken together created very different results in the primary latitudes studied: the equatorial tropic zone; the midlatitudes that include most of the U.S.; and the boreal areas, which are subarctic and include much of Canada, Russia and the northern extremities of the U.S.

In all three regions, forests dutifully perform their task of sucking carbon dioxide from the air, but light absorption and evotranspiration vary wildly. In tropical zones, forests have a significant, overall cooling effect. The soil is very wet and, so, via evotranspiration, the trees are covered by low-lying clouds that create a small albedo (power of light that is reflected by a surface). In nontropical areas, Caldeira explains, "the real significant factor is whether there's snow on the ground in the winter." If a forest covers a snowy expanse, "that has a strong warming influence," he notes, because of little cloud cover resulting from less efficiency in evaporating water. The poor cloud formation coupled with the intense absorption of light by the trees "far overwhelms the cooling influence of the carbon storage," he says.

"In midlatitudes, we got that it was basically a wash—the carbon dioxide effects were pretty much directly balanced by the physical effects," Caldeira says. He attributes this to the low contrast between light absorption from trees and from grass in pastures, though he notes that because there are some areas with wintry snow cover, the loss of a forest will probably have a slight, if any, cooling effect. He uses this example to point out the relative influence of the different forest functions. Whereas carbon levels can affect warming on a global scale, the effects of increased albedo and poor evotranspiration would affect temperatures only on a regional level. For instance, he says, "if you remove all the forest in the U.S., it would probably heat up the world, but have a slight cooling influence on the U.S., itself."

Navin Ramankutty, an assistant professor of geography and Earth system sciences at McGill University in Montreal, says this study is the first to take a comprehensive look at the consequences of deforestation on the entire world. "You can't just blindly go ahead and reforest and that will tackle climate change," he says, pointing out a key finding in the study. "If you think about conservation groups, they're all talking about planting trees. We should be protecting tress for other reasons."

Caldeira agrees, saying that protecting the forest should be part of an effort to sustain the world's biodiversity. He also adds that the findings do not endorse clear-cutting or destroying wildlife habitats. "I think that it's important to look at preventing climate change as a means rather than an end in itself," he says. "Too narrow a focus on global warming and a loss of the broader focus of protecting life on this planet can lead to perverse outcomes." Rather than looking to forests to solve the current climate crisis by capturing carbon dioxide, he suggests targeting our "energy system," which continues to create the pollutant.

OPINION: GLOBAL WARMING FEARS OVERBLOWN

GUEST OPINION

By Richard S. Lindzen

Special to Newsweek

April 16, 2007 issue—Judging from the media in recent months, the debate over global warming is now over. There has been a net warming of the earth over the last century and a half, and our greenhouse gas emissions are contributing at some level. Both of these statements are almost certainly true. What of it? Recently many people have said that the earth is facing a crisis requiring urgent action. This statement has nothing to do with science. There is no compelling evidence that the warming trend we've seen will amount to anything close to catastrophe. What most commentators—and many scientists—seem to miss is that the only thing we can say with certainty about climate is that it changes. The earth is always warming or cooling by as much as a few tenths of a degree a year; periods of constant average temperatures are rare. Looking back on the earth's climate history, it's apparent that there's no such thing as an optimal temperature—a climate at which everything is just right. The current alarm rests on the false assumption not only that we live in a perfect world, temperaturewise, but also that our warming forecasts for the year 2040 are somehow more reliable than the weatherman's forecast for next week.

A warmer climate could prove to be more beneficial than the one we have now. Much of the alarm over climate change is based on ignorance of what is normal for weather and climate. There is no evidence, for instance, that extreme weather events are increasing in any systematic way, according to scientists at the U.S. National Hurricane Center, the World Meteorological Organization and the Intergovernmental Panel on Climate Change (which released the second part of this year's report earlier this month). Indeed, meteorological theory holds that, outside the tropics, weather in a warming world should be less variable, which might be a good thing.

In many other respects, the ill effects of warming are overblown. Sea levels, for example, have been increasing since the end of the last ice age. When you look at recent centuries in perspective, ignoring short-term fluctuations, the rate of sea-level rise has been relatively uniform (less than a couple of millimeters a year). There's even some evidence that the rate was higher in the first half of the twentieth century than in the second half. Overall, the risk of sea-level rise from global warming is less at almost any given location than that from other causes, such as tectonic motions of the earth's surface.

Many of the most alarming studies rely on long-range predictions using inherently untrustworthy climate models, similar to those that cannot accurately forecast the weather a week from now. Interpretations of these studies rarely consider that the impact of carbon on temperature goes down—not up—the more carbon accumulates in the atmosphere. Even if emissions were the sole cause of the recent temperature rise—a dubious proposition—future increases wouldn't be as steep as the climb in emissions.

Indeed, one overlooked mystery is why temperatures are not already higher. Various models predict that a doubling of CO₂ in the atmosphere will raise the world's average temperature by as little as 1.5 degrees Celsius or as much as 4.5 degrees. The important thing about doubled CO₂ (or any other greenhouse gas) is its "forcing"—its contribution to warming. At present, the greenhouse forcing is already about three-quarters of what one would get from a doubling of CO₂. But average temperatures rose only about 0.6 degrees since the beginning of the industrial era, and the change hasn't been uniform—warming has largely occurred during the periods from 1919 to 1940 and from 1976 to 1998, with cooling in between. Researchers have been unable to explain this discrepancy.

Modelers claim to have simulated the warming and cooling that occurred before 1976 by choosing among various guesses as to what effect poorly observed volcanoes and unmeasured output from the sun have had. These factors, they claim, don't explain the warming of about 0.4 degrees C between 1976 and 1998. Climate modelers assume the cause must be greenhouse-gas emissions because they have no other explanation. This is a poor substitute for evidence, and simulation hardly constitutes explanation. Ten years ago climate modelers also couldn't account for the warming that occurred from about 1050 to 1300. They tried to expunge the medieval warm period from the observational record—an effort that is now generally discredited. The models have also severely underestimated short-term variability El Niño and the Intraseasonal Oscillation. Such phenomena illustrate the ability of the complex and turbulent climate system to vary significantly with no external cause whatever, and to do so over many years, even centuries.

Is there any point in pretending that CO₂ increases will be catastrophic? Or could they be modest and on balance beneficial? India has warmed during the second half of the 20th century, and agricultural output has increased greatly. Infectious diseases like malaria are a matter not so much of temperature as poverty and public-health policies (like eliminating DDT). Exposure to cold is generally found to be both more dangerous and less comfortable.

Moreover, actions taken thus far to reduce emissions have already had negative consequences without improving our ability to adapt to climate change. An emphasis on ethanol, for instance, has led to angry protests against corn-price increases in Mexico, and forest clearing and habitat destruction in Southeast Asia. Carbon caps are likely to lead to increased prices, as well as corruption associated with permit trading. (Enron was a leading lobbyist for Kyoto because it had hoped to capitalize on emissions trading.) The alleged solutions have more potential for catastrophe than the putative problem. The conclusion of the late climate scientist Roger Revelle—Al Gore's supposed mentor—is worth pondering: the evidence for global warming thus far doesn't warrant any action unless it is justifiable on grounds that have nothing to do with climate.

Lindzen is the Alfred P. Sloan Professor of Meteorology at the Massachusetts Institute of Technology. His research has always been funded exclusively by the U.S. government. He receives no funding from any energy companies.

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Mr. ROHRABACHER. Mr. Chairman, we are experiencing a certain amount of warming on the planet. There is no doubt about that, and I am a senior member of the Science Committee, and sat through about five hearings on this with very top scientists. There is no doubt that there is a certain amount of warming going on. The question is whether mankind has anything to do with it any more than we have had to do with the other about 12 different cycles of warming and cooling that the earth has gone through over its long history.

There is no reason to believe that this warming which is one degree over 100 years or a degree and a half warmer than it was 150 years ago is caused by human activity. That is not caused by human activity and probably the warming on Mars and on the planet that NASA is now reporting is probably not caused by human activity, unless of course there is some connection with UFOs to global warming, which I doubt.

So let me just suggest, Mr. Chairman, that there is a price to pay if we get stampeded into trying to solve a problem that does not exist or look for solutions for things that cannot be solved. If indeed it is a natural cycle caused by sunspots perhaps as many top professors have suggested, if we go off and spend hundreds of billions of dollars which is what it would cost us for some of the plans that are coming forward on global warming, we will take those resources away from doing things that make people healthier, and we will take things away from what would really help the poor people on this planet.

And finally for the record I would just like to read a quote, and then I will be done with this, and we will get into the testimony. Dr. Christopher Landsea who was indeed part of the IPCC program, Dr. Landsea of course is someone who has very strong credentials and a Professor at the University of Colorado, of course has a Ph.D. in meteorology, he suggested that he had to withdraw from the IPCC report and withdraw his endorsement, and it says:

"I have raised my concerns to the IPCC leadership. The response was simply to dismiss my concerns. I personally cannot in good faith continue to contribute to a process that I view as

both being motivated by preconceived agendas and being scientifically unsound.”

This is a prominent scientist. There are prominent scientists throughout the world who are calling into question these hysterical predictions of global warming, and in each and every case instead of meeting their objections, instead of going through the discussions and saying what are your objections and trying to deal with it, which is the honest way of approaching any major issue, they have been dismissed.

And every time I have heard a report on global warming, Mr. Chairman, it always begins with the same thing, the issue is already decided, and this is nothing but a way to prevent an honest discussion of the issue itself, and I would suggest that we are a long way from determining that human beings are causing this cycle of warming that is happening on the planet any more than we caused the cycle of warming on the planet for the last other 10 cycles that the earth has been through.

So I am interested in hearing what the witnesses have to say and participating in the dialogue, and even though we disagree, Mr. Chairman, you have my 100 percent respect. Thank you.

Chairman LANTOS. It is very mutual, Mr. Rohrabacher. Gentleman from Texas, Mr. Green.

Mr. GREEN. Thank you, Mr. Chairman, for holding this hearing on America’s engagement in global efforts to fight climate change. In addition to this committee, I serve on the House Energy and Commerce Committee which will be responsible for moving legislation on climate change. This issue hits close to home literally because the district I represent is home to much of the industry that has most to lose if we do not take a cautioned approach to the climate change.

What American industry can do domestically is address climate change will not matter if countries like Russia, China and India do not take steps simultaneously to cut CO2 emissions. We must ensure any legislation we pass and steps we take to address climate change are not done so unilaterally. The United States we can provide the leadership but we also need to make sure that we are not adversely affecting our own economy. Doing so would not solve the problem of global warming but result in a tremendous burden on our economy in the form of higher energy prices.

Our goal should be a climate and energy policy that maximizes the greenhouse gas emission reductions on a global scale while minimizing negative impacts on our economy. Congress should evaluate all possible options to achieve this objective including basing access to our market on reductions in the countries’ carbon emissions or other effective incentives. Climate change is a global problem. We must look for a global solution, and again I thank the chairman for holding the hearing. I look forward to our witnesses.

Chairman LANTOS. Thank you very much. Ms. Watson of California.

Ms. WATSON. I want to thank our chairman. Again your foresight and your good common sense helps to educate us all, and I am very pleased with the witnesses that come to bring us factual and I hope empirical evidence that we are living in an era where man must

start looking at the future and to see how we can contribute to improving the future for our offspring and those yet unborn.

So the public debate on energy and global warming and climate change has shifted dramatically in the American public's mind over the past few years, and this sense of urgency is based in great part on the assumption that the United States of America has fallen behind as a leading innovator in demonstrating new developing and innovating and in developing new energy technology and instead has become a captive of big oil and the nations and the regions of the world from which it comes.

Energy independence, global warming and climate change now stand on top of the American public's agenda and are right up there with health care as one of the most important issues of the day, and simply put, America has awakened and now knows that it cannot wait to follow but must lead and if we are going to change our destiny. So I feel it is very, very important that we have these hearings and have the scientists and the experts give us the input that we will need to plan for our future. Thank you very much, Mr. Chairman.

Mr. GREEN [presiding]. Thank you. The chair recognizes our ranking member, Ms. Ros-Lehtinen, for introductions.

Ms. ROS-LEHTINEN. Thank you so much, Mr. Chairman. Before we continue with our opening statements, I would like to take a moment to welcome Congressman Bilirakis as our newest member of our committee on the Republican side of the aisle. In addition to his new role, Gus serves on the House Committee on Homeland Security as well as a member of the Committee on Veterans Affairs. He is recognized for his spirit of bipartisanship and fairness and accomplishment of key priorities, and I know that he is going to make a valuable addition to our committee.

I had the great honor of serving—as many of us did—with Gus' dad, Mike, for many years, and I have known Gus for many years as well, as he was a state legislature, and Mr. Chairman, I ask unanimous consent that Gus be assigned to both the Subcommittee on Europe and the Subcommittee on Middle East and South Asia, and unfortunately we have to say goodbye to Congressman McCotter. He is joining the Financial Services Committee. He has been a member of our Foreign Affairs Committee for 4½ years, and his participation will surely be missed but Mr. Bilirakis will overshadow him in no time. Thank you, Mr. Chairman.

Mr. GREEN. Thank you. Without objection Mr. Bilirakis will be assigned in those two subcommittees, and again welcome. Like our colleague said, I served many years on the Energy and Commerce Committee with your father, and welcome to Congress. Our next member is Congresswoman Woolsey.

Ms. WOOLSEY. Thank you, Mr. Chairman. I just traveled to China before Easter, and we had a roundtable of Members of Congress and scholars, Chinese scholars, and we were discussing global warming, and one of the Chinese scholars said, well it is the opinion and the thought of the Chinese that the United States has used up more than your fair share of the resources around the world and you have caused more than your fair share of pollution. Now it is our turn.

Well my response was, yes, indeed we have absolutely taken advantage and used more of our share than we should have, and we need to make up for that. But there is no time for China to have a turn if we intend to have any kind of atmosphere and environment for all the children of the world. So I am really looking forward to hearing from you, and this is a global concern, and we have to work on it globally. Thank you very much.

Mr. GREEN. Mr. Boozman from Arkansas.

Mr. BOOZMAN. Thank you. I really do not have much comment except for the fact we appreciate you being here. This certainly is a very important topic, and again look forward to you know working, doing things based on sound science and you know trying to take the emotion out of this. Thank you, Mr. Chairman.

Mr. GREEN. Thank you. The chair recognizes Mr. Crowley of New York.

Mr. CROWLEY. I have no opening statement but I look forward to hearing the testimony.

Mr. GREEN. Mr. Miller.

Mr. MILLER. Mr. Chair, on the off chance that the witnesses know more about their life's work than the members of the committee do, I will waive an opening statement so we may hear from them.

Mr. GREEN. The chair recognizes Mr. Chabot from Ohio.

Mr. CHABOT. As my colleagues have done, in order to get to the witnesses as quickly as possible, I will forego making an opening statement at this time. Thank you.

Mr. GREEN. Mr. Bilirakis, opening statement?

Mr. BILIRAKIS. Well, Mr. Chairman, thank you. It is just an honor to serve on this committee with you and Chairman Lantos and my good friend, Ranking Member Ileana Ros-Lehtinen, and I look forward to doing some good work. Thank you so much.

Mr. GREEN. No more opening statements. Again welcome to our panel, and I will introduce our panel. Eileen Claussen is one of the great recognized experts on climate change as well as environmental issues more broadly. She is currently the president of the Pew Center on Global Climate Change and Strategies for the Global Environment. Ms. Claussen is the former assistant secretary for Oceans and International Environmental and Scientific Affairs where she dealt with issues ranging from ozone depletion, climate change, natural resources.

Prior to that position, she served for 3 years on the National Security Council as special assistant to the president, as senior director for Global Environmental Affairs. From 1987 to 1993, Ms. Claussen was director of Atmospheric Programs at the U.S. Environmental Protection Agency capping a long and distinguished career at the EPA by spearheading policies, reversing the much publicized hole in the ozone layer. She is the executive editor of the book *Climate Change, Science and Strategies and Solutions*. We look forward to your testimony, Ms. Claussen.

Why do I not go ahead and introduce all of our witnesses, and that way we will just go from witness-to-witness? Our next distinguished witness is Dr. David Jhirad. He is currently the vice president at the World Resources Institute, an environmental think tank focused on feasible solutions. He served as Deputy Assistant

Secretary of Energy for International Energy Policy in the Clinton-Gore administration.

In that post he led the United States bilateral energy negotiations with all key energy producing and consuming countries, and he served as vice chair of the International Energy Agency. Dr. Jhirad has authored more than 100 publications on energy security and climate issues. He has received his doctorate in applied physics from Harvard University. He was a senior energy advisor to the USAID, and a senior scientist at Brookhaven National Laboratory. We are pleased to have a witness with such an extensive background in international energy policy and cooperation, Dr. Jhirad. The floor will be yours shortly.

W. David Montgomery is vice president of the consultancy CRA where he serves as co-head of the firm's international environmental energy and environmental practice. He was principle lead author of the second assessment report of the Intergovernmental Panel on Climate Change working group three. The IPCC is the international body tasked with assessing climate change and its ramifications.

Dr. Montgomery is an expert on economics surrounding climate change and climate change policy. Dr. Montgomery's current research deals with the design of energy R&D policy as well the reduction of greenhouse gas emissions in developing countries. Prior to joining CRA, he was the assistant director of the U.S. Congressional Budget Office and Deputy Assistant Secretary for Policy in the U.S. Department and Energy.

He taught economics at the California Institute of Technology and Stanford University. He was a senior fellow at Resources for the Future. Dr. Montgomery, again welcome. And Ms. Claussen, if you will proceed.

**STATEMENT OF THE HONORABLE EILEEN CLAUSSEN,
PRESIDENT, PEW CENTER ON GLOBAL CLIMATE CHANGE**

Ms. CLAUSSEN. Mr. Chairman, members of the committee, thank you for the opportunity to testify on this critical issue. My name is Eileen Claussen, and I am the President of the Pew Center on Global Climate Change. Let me summarize my written statement by responding to the questions I was asked to address.

Can global greenhouse concentrations be stabilized without obtaining binding pledges from key developing countries? I believe that stabilizing greenhouse gas concentrations at safe levels will require binding commitments from all the major emitting countries, both developed and developing. However, the form of commitment need not be the same for all countries.

There is tremendous diversity among the major economies. Twenty-five countries account for about 85 percent of global greenhouse gas emissions, 70 percent of global population, and 85 percent of global GDP, but their per capita emissions range by a factor of 14, and their per capita incomes by a factor of 18.

Policies and pathways that work for some of these countries will not work for others. We need a flexible international framework that accommodates different national strategies and circumstances. However, while we should allow a variety of approaches, these must be integrated in a common overarching framework since no

country can sustain an ambitious climate effort if its counterparts are not contributing their fair share.

What might the elements of a new agreement look like? We believe there are five potential elements of a post 2012 framework. The first is economy wide emission targets and trading, similar to what is proposed for the United States in many of the major climate bills now before Congress. Emission targets provide environmental certainty while trading harnesses market forces to deliver reductions at the lowest possible cost.

However, China, India and other developing countries are highly unlikely to accept binding economy wide emission limits because they believe such targets will limit their economic growth. An alternative approach for them could be policy based commitments where they undertake national policies, energy efficiency or renewable energy targets for example. These commitments would need to be credible and binding with mechanisms to ensure close monitoring and compliance.

A third potential element would target emissions from a specific sector. Such agreements could resolve competitiveness concerns in energy intensive industries whose goods trade globally, for example aluminum production. A fourth potential element is technology co-operation, both to jointly develop critical breakthrough technologies such as carbon capture and storage and to help ensure equitable access globally to both existing and new technologies. Finally, a post 2012 framework must provide stronger international support for adaptation efforts in the poor countries that are most vulnerable to climate impacts and least able to cope.

Should a new climate framework set a specific long-term goal for stabilizing greenhouse gas concentrations? A quantified long-term goal could be extremely valuable in driving climate action, signaling markets, and establishing a metric to guide and assess our near and medium term efforts. However, we do not believe such a goal should be negotiated nor should it be the basis for commitments. The U.S. Climate Action Partnership—of which the Pew Center is a founding partner—recommends stabilizing global greenhouse concentrations at a carbon dioxide equivalent level of 450–550 parts per million. There would be great benefit if such a target could be accepted without negotiation.

Does the U.N. Framework Convention on Climate Change provide a viable foundation for a post 2012 framework? We believe the Framework Convention is the appropriate venue for negotiating new climate commitments. The Convention enshrines key principals that have been universally accepted and is flexible enough to accommodate any of the approaches I have described. However, the broad political consensus needed for such negotiations to succeed may be most readily achieved through high level dialogue outside the formal process, but once achieved this consensus should be carried back into the Framework Convention for the negotiation of formal agreements.

Finally, what steps can the United States take to most effectively reengage in the global climate effort? An effective multilateral response to climate change is possible only with U.S. engagement and leadership. The most critical step we can take to encourage global action is to establish a mandatory program to limit and re-

duce U.S. emissions. We also must help lead a renewed a multilateral effort both formally within the Framework Convention process and informally outside the process.

Engaging developing countries will require a firm but balanced approach. We must be absolutely clear in our expectations that the major developing countries assume binding commitments in a post 2012 framework. In establishing mandatory limits on our own emissions, we will have begun to fulfill the commitment we made with other developed countries to lead the climate effort.

Having done so, it will then be reasonable to expect that countries like China fulfill their responsibilities as well. China's emissions have grown 80 percent since 1990, and could rise another 80 percent by 2020. It is essential that these trends be reversed. Realistically this will also require incentives for them to undertake strong climate efforts. But in return for these incentives, China and the other major developing countries must assume appropriate commitments that will slow and ultimately reverse the growth of their greenhouse gas emissions.

To summarize, I believe it is incumbent upon the United States to lead both by strong action at home and by actively and constructively reengaging in the international climate effort. Only with strong U.S. participation and leadership can we achieve a fair and effective global response to the critical challenge of climate change. I thank the committee for the opportunity to present these views and would be happy to answer any questions.

[The prepared statement of Ms. Claussen follows:]

PREPARED STATEMENT OF THE HONORABLE EILEEN CLAUSSEN, PRESIDENT, PEW
CENTER ON GLOBAL CLIMATE CHANGE

Mr. Chairman and members of the committee, thank you for the opportunity to testify on U.S. Re-Engagement in the Global Effort to Fight Climate Change. My name is Eileen Claussen, and I am the President of the Pew Center on Global Climate Change.

The Pew Center on Global Climate Change is a non-profit, non-partisan and independent organization dedicated to providing credible information, straight answers and innovative solutions in the effort to address global climate change.¹ Forty-three major companies in the Pew Center's Business Environmental Leadership Council (BELC), most included in the Fortune 500, work with the Center to educate the public on the risks, challenges and solutions to climate change.

Mr. Chairman, I would like to commend you and the members of this committee for convening this hearing today on U.S. re-engagement in the global effort to fight climate change. As one who has worked for many years to advance efforts on this and other critical environmental challenges, it is very gratifying to me that the U.S. Congress is at long last engaged in a genuine debate on how—not if, but how—the United States should address global climate change. So far, this debate has focused primarily on questions of domestic climate policy. This is a critical first step. But truly meeting the challenge of climate change will require global solutions as well, and these will be possible, I believe, only with strong leadership from the United States. By broadening the scope of debate here in Washington, and by focusing attention on the international dimension of climate change, this hearing will help set the stage for constructive U.S. engagement and for an effective multilateral response to global climate change.

In my testimony today, I would like to outline the following: the key objectives that a post-2012 climate framework must meet; the form that a post-2012 framework should take; the steps the United States must take at home and internationally to ensure that such a framework is established; and how the United States can best address the questions of competitiveness and developing country participation.

¹ For more on the Pew Center, see www.pewclimate.org.

In the course of my testimony, I will address each of the questions the Committee has posed.

The Pew Center's perspective on the future international framework reflects not only our own detailed analysis but also the collective views of an impressive group of policymakers and stakeholders from around the world. As part of our effort to help build consensus on these issues, we convened the Climate Dialogue at Pocantico, a group of 25 from government, business, and civil society in 15 key countries, all participating in their personal capacities. The group included senior policymakers from Britain, Germany, China, India, Japan, Australia, Canada, Mexico, Brazil and the United States. It also included senior executives from companies in several key sectors, including Alcoa, BP, DuPont, Exelon, Eskom (the largest electric utility in Africa), Rio Tinto, and Toyota. The group's report was released in late 2005 at an event here in Congress hosted by Senators Biden and Lugar.²

Despite a very diverse range of interests and perspectives, the Pocantico group succeeded in reaching consensus on a broad vision of a post-2012 climate framework. This vision begins with a set of key objectives that a post-2012 framework must meet. I would like to emphasize the two most critical objectives, which speak directly to the Committee's question about the need for and nature of developing country participation.

First, the post-2012 framework must engage all of the world's major economies. Twenty-five countries account for about 85 percent of global greenhouse gas emissions. These same countries also account for about 70 percent of global population and 85 percent of global GDP. The participation of all the major economies is critical, first and foremost, from an environmental perspective, because all must take sustained action if we are to achieve the steep reductions in emissions needed in the coming decades to avert dangerous climate change. But the participation of all major economies is critical from a political perspective as well. For reasons of competitiveness, none of these countries will be willing to undertake a sustained and ambitious effort against climate change without confidence that the others are contributing their fair share. We must agree to proceed together.

At the same time, we must recognize the tremendous diversity among the major economies. This group includes industrialized countries, developing countries, and economies in transition. Their per capita emissions range by a factor of 14 and their per capita incomes by a factor of 18. This leads directly to the second objective identified in our Pocantico dialogue: The post-2012 framework must provide flexibility for different national strategies and circumstances. The kinds of policies that effectively address climate change in ways consistent with other national priorities will vary from country to country. We must allow different pathways for different countries. An economy-wide emissions target may work for some but it will not work for others. If it is to achieve broad participation, the future framework must allow for variation both in the *nature* of commitments taken by countries and in the time-frames within which these commitments must be fulfilled.

With these key objectives in mind, the Pocantico group then considered one of the other questions the Committee has asked: What could be the key elements of a post-2012 framework? The group recommended several policy approaches.

The first of these is targets and trading. This is the approach employed in the Kyoto Protocol, as well as in the European Union's Emissions Trading Scheme and the Regional Greenhouse Gas Initiative being undertaken by ten states in the northeastern United States. There are very sound reasons why U.S. negotiators insisted so strongly on a market-based architecture for the Kyoto Protocol—and why many of the major climate bills now before Congress adopt the same approach. Emission targets provide a reasonable degree of environmental certainty, while emissions trading harnesses market forces to deliver those reductions at the lowest possible cost.

While targets and trading should remain a core element of the international effort, we must recognize that China, India, and other developing countries are highly unlikely to accept binding economy-wide emission limits any time in the foreseeable future. In their view, binding targets, by holding them to specific emission levels regardless of the economic consequences, would amount to a cap on economic growth. Economy-wide targets also may be technically impractical for them: to accept a binding target, a country must be able to reliably quantify its current emissions and project its future emissions, a capacity that at present few if any developing countries have.

A future framework, therefore, must allow for other approaches as well. A second potential element identified in the Pocantico dialogue is policy-based commitments.

² International Climate Efforts Beyond 202—the Report of the Climate Dialogue at Pocantico, is available at <http://www.pewclimate.org/pocantico.cfm>.

Under this approach, countries would commit to undertake national policies that will moderate or reduce their emissions without being bound to an economy-wide emissions limit. This is a more bottom-up approach, allowing countries to put forward commitments tailored to their specific circumstances and consistent with their core economic or development objectives. A country like China, for instance, could commit to strengthen its existing energy efficiency targets, renewable energy goals, and auto fuel economy standards. Tropical forest countries could commit to reduce deforestation. For this to work, the commitments would need to be credible and binding, with mechanisms to ensure close monitoring and compliance. Developed countries also may need to provide incentives for developing countries to adopt and implement stronger policies. One option is policy-based emissions crediting, similar to the Kyoto Protocol's Clean Development Mechanism, granting countries tradable emission credits for meeting or exceeding their policy commitments.

A third potential element is sectoral agreements, in which governments commit to a set of targets, standards, or other measures to reduce emissions from a given sector, rather than economy-wide. In energy-intensive industries whose goods trade globally, which are the sectors most vulnerable to potential competitiveness impacts from carbon constraints, sectoral agreements can help resolve such concerns by ensuring a more level playing field. Such approaches are being explored by global industry groups in both the aluminum and cement sectors. We believe it is also worth exploring sectoral approaches in other sectors such as power and transportation where competitiveness is less of an issue but where large-scale emission reduction efforts are most urgent.

A fourth potential element is technology cooperation. This could include two types of agreements. The first would provide for joint research and development of "breakthrough" technologies with long investment horizons. Such agreements could build on the Asia Pacific Partnership and other technology initiatives but commit governments to the higher levels of funding needed to accelerate and better coordinate critical research and development. The second type of agreement could help to provide equitable access to both existing and new technologies by addressing finance, international property rights, and other issues that presently impede the flow of low-carbon technologies to developing countries.

The four elements I have outlined thus far fall under the heading of mitigation. A fifth critical element is adaptation. We need stronger adaptation efforts within the international climate framework but extending well beyond it as well. The top priority within the framework should be addressing the urgent needs of those countries most vulnerable to climate change. But the broader goal must be to spur comprehensive efforts to reduce climate vulnerability generally by integrating adaptation across the full range of development activities.

The Pocantico group also considered another question raised by the Committee: whether a new climate framework must establish a specific goal for stabilizing greenhouse gas concentrations in the atmosphere. The UN Framework Convention on Climate Change (UNFCCC) set a long-term objective for the international climate effort: stabilizing atmospheric greenhouse gas concentrations at levels that would prevent dangerous human interference with the climate system. Thus far, there has been no effort under the Convention to define that goal in quantitative terms. The Pocantico group clearly recognized the value of a quantified long-term goal in driving climate action, signaling markets, and establishing a metric to guide and assess near- and medium-term efforts. However, the group cautioned against trying to negotiate a specific quantified long-term target, particularly one intended as a basis for commitments. The scientific issues are so complex, and the inherent political stakes so great, that such a negotiation would likely be futile if not counterproductive. In my view, global consensus on a quantified long-term climate goal will be feasible only if the issue is taken up in an international venue other than that where climate commitments are to be negotiated. The U.S. Climate Action Partnership, of which the Pew Center is a founding partner, recommends stabilizing global greenhouse concentrations at a carbon dioxide equivalent level of 450–550 ppm.

Having outlined the potential elements of a post-2012 climate effort, I now turn to the question of how these approaches can be integrated in a common framework. While different countries should be allowed different pathways, they cannot simply each go their own way. An ad hoc series of parallel initiatives will not produce an aggregate effort nearly adequate to the need. By linking actions, and negotiating them as a package, nations are likely to undertake a higher level of effort than they would acting on their own. Such a negotiation could take the form of sequential bargaining, with countries proposing what they are prepared to do under one or more of the different tracks I've described, and then adjusting their proposals until agreement is reached on an overall package. To help ensure a balanced and therefore stronger outcome, it may be necessary to agree at the outset that certain countries

will negotiate toward particular types of commitments most appropriate to their circumstances. The objective would be an integrated agreement is flexible enough to accommodate different types of commitments, and reciprocal enough to achieve a strong, sustained level of effort.

The Committee has asked whether the UNFCCC provides a viable foundation for a global climate framework. I believe the answer is yes. The Pocantico group recognized that one precondition for a successful negotiation is broad political consensus among the key players and, accordingly, urged an informal high-level dialogue among the major economies on the broad scope and terms of a post-2012 framework. However, the group agreed that once this informal consensus is reached, it should be carried back to the Framework Convention for the negotiation of formal agreements. The Convention enshrines key principles, such as “common but differentiated responsibilities,” and has been ratified by virtually every nation on earth, including the United States. It is regarded worldwide as the legitimate forum for negotiating and mobilizing the international climate effort. Further, the Convention is flexible enough to accommodate any of the approaches I have described here. The U.N. and Convention processes are often cited as obstacles to agreement on climate change. While these processes are far from perfect, I believe the largest obstacle to date has been a lack of political will, and if that obstacle were to be removed, process issues would not stand in the way of agreement.

The Committee has also asked what steps the United States can take to most effectively reengage in the global climate effort. An effective multilateral response to climate change will be possible only with U.S. engagement and leadership. Lack of action by the United States stands today as the major impediment to stronger efforts by other countries. Of the steps the United States can take to encourage global action, the most critical is to establish unilaterally a mandatory program to limit and reduce U.S. emissions. Demonstrating the will—and establishing the means—to reduce U.S. emissions will greatly alter the international political dynamic and improve prospects for international cooperation.

As it strengthens its domestic response to climate change, the United States should also help lead a renewed multilateral effort both within and outside the Framework Convention process. Within the Convention process, the United States should support the launch of a new round of negotiations, either in parallel with or subsuming those already underway under the Kyoto Protocol, seeking a balanced package of commitments among the major-emitting countries. The Conference of the Parties later this year in Bali presents an opportunity to launch such negotiations. Such negotiations will be fruitful, however, only if other efforts are taken in parallel to build confidence and seek political consensus among the major economies. The Gleneagles Dialogue launched by the G8+5 in 2005 has brought together the 20 largest energy-consuming countries to discuss issues of climate, energy, and development. If given a stronger mandate when it reports back to the G8+5 in 2008, this Dialogue could be a serve as the venue for developing the political consensus needed for the formal negotiations to succeed. If not, an alternative venue for this critical political dialogue will be needed.

Finally, I would like to address directly the questions of competitiveness and developing country participation. These issues are closely related. Ultimately, I believe, both are most effectively addressed through binding multilateral commitments. But it is important to distinguish these two issues because, in advance of a stronger global framework, each will require a different set of interim policy responses.

Competitiveness is a potential concern not for the U.S. economy as a whole, but rather for specific sectors—primarily energy-intensive industries, such as steel and aluminum, whose goods trade globally. In establishing a mandatory domestic climate program, steps can be taken to minimize or mitigate competitiveness impacts. For instance, in the design of a mandatory cap-and-trade program, potentially vulnerable sectors could be allowed special consideration in the emission allowance process. Another option is to provide technology and transition assistance to affected industries and communities, possibly funded by auctioning a portion of allowances. As a longer-term option, legislation also could stipulate that if the major developing countries have not taken stronger action to reduce emissions within a specified timeframe, the United States, in concert with other industrialized countries, will consider tariffs on their energy-intensive exports or other mechanisms to correct the resulting competitive imbalances. I would note that on their own, however, these latter approaches are not likely to induce strong developing country action, and could lead to more confrontation than cooperation.

Engaging developing countries will require a firm but balanced approach. To begin with, we must be absolutely clear in our expectation that the major developing countries assume binding commitments in a post-2012 framework. It is true that the

United States, the world's largest economy, is also by far the largest historic contributor to climate change. In establishing mandatory limits on domestic emissions, the United States will have begun to fulfill the commitment it made with other industrialized countries to lead the climate change effort. And having done so, it will then be reasonable to expect that countries like China fulfill their responsibilities as well. China's emissions have grown 80 percent since 1990 and could rise another 80 percent by 2020. It is essential that these trends be reversed. Realistically, given the greater capacity and historic responsibility of industrialized countries, China, India and other developing countries will require incentives to undertake strong climate efforts. The United States should provide market-based incentives through a domestic cap-and-trade program by recognizing credits for emission reductions achieved in developing countries. In addition, targeted bilateral and multilateral assistance should be provided for the deployment of critical high-cost technologies such as carbon-capture-and storage. However, in return for these incentives, China and the other major developing countries must assume appropriate commitments that will slow and ultimately reverse the growth of their greenhouse gas emissions.

To summarize, I believe it is incumbent upon the United States to lead both by strong action at home and by actively and constructively reengaging in the international climate effort. Only with strong U.S. participation and leadership can we achieve a fair and effective global response to the critical challenge of climate change. I thank the Committee for the opportunity to present these views and would be happy to answer your questions.

Mr. GREEN. Dr. Jhirad.

**STATEMENT OF DAVID JOHN JHIRAD, PH.D., VICE PRESIDENT
FOR SCIENCE AND RESEARCH, WORLD RESOURCES INSTITUTE**

Mr. JHIRAD. Thank you, Mr. Chairman and distinguished members of the committee. Thank you. I am David Jhirad, Vice President for Science and Research of the World Resources Institute. According to the International Energy Agency (IEA), the world has embarked on an energy path that is incompatible with achieving a stable climate for the earth and its people, and that the IEA also confirms that we are following an energy trajectory that is economically and financial unstable and poses serious threats of regional and global conflict.

In spite of the fact that we face as a nation and as an international community daunting challenges in transforming the situation. The long-term solutions are, as the chairman said earlier: To stabilize greenhouse gas emissions in the atmosphere; to enhance energy security; to reduce the risk of economic and political disruption; the task of providing commercial energy to 4 billion people on the planet; and mobilizing over 20 trillion in capital mobilization over the next 25 years for energy infrastructure.

I will not dwell on the science of climate change except to say that the end of the scientific debate has essentially occurred, and there are now calls for action. The focus has turned to action, and it is essential that the United States take strong action at the national level to reduce emissions.

The rest of the world cannot solve this problem if we stay out, and action by the United States will make it clear that in tomorrow's markets there will be a price for carbon that will give U.S. companies an advantage in preparing to compete in those markets. This is why 21 leading U.S. businesses—including large energy consumers such as General Electric, AIG, Alcoa, Caterpillar, DuPont, John Deere, Duke and others—of which WRI, the World Resources Institute and my colleague here from the Pew Center joined in this group. They called on and urged Congress to enact

mandatory measures to slow, stop and reverse the growth in U.S. greenhouse gas emissions.

This U.S. Climate Action Partnership (USCAP) was formed in January, and it has issued a call for action that provides recommendations to the Congress and the administration on mandatory, economy-wide policy designed to achieve emissions reductions of 60–80 percent by 2050. An essential prerequisite for our re-engaging in the international arena is that we have credibility and legitimacy at home.

We need to have strong Federal legislation that captures the twin benefits of reduced petroleum consumption and greenhouse gas emissions. This will allow us to play a more constructive role in international fora along the lines that my colleague has just described.

And it is absolutely key that our credibility in the international arena be established at home by establishing a price for carbon. We know how to create markets, and we know how to make them work, and this is the vital starting point if we are to re-engage the rest of the world, and the drivers for this transformation are clear. They have to be government policy and private sector development.

We are very hopeful about the technologies we will need and the scale we will need them on to stabilize greenhouse gas emissions and later concentrations. There is a simple, powerful idea that despite this daunting problem that I have described, we have the potential to solve it if we can deploy today's technology at sufficient scale.

This allows us a way of coming to grips with the problem of technologies to scale such as carbon capture and storage, efficient transportation in vehicle technologies, biofuels from cellulosic and other nonstarch sources, and renewables on an unprecedented scale. The important point here is that we can solve this problem. We can solve this with policy leadership, policy innovation, technological innovation and capital investment.

We will need more than \$20 trillion, as I said, over the next 25 years in the world to invest in technology. There are already signs that Wall Street is paying attention to this. Citibank has assigned a fund of \$50 billion for investment in noncarbon, zero carbon technologies, and we see that others in the financial community are beginning to factor climate risk into their investment portfolios. That sends a very important signal to the rest of the world.

Turning to India and China, greenhouse gases are not an immediate concern but what is a concern is the rush for investment, energy security and the staggering cost of pollution in terms of human life. What I would suggest, from my own experience at the International Energy Agency, is that there is a strong case to be made to include India and China as member countries of the International Energy Agency where they will participate along with other countries in transparent regulatory and other measures to attract capital to clean energy technologies.

Much of what I have said is in my written testimony, members of the committee, so I will quickly move to a few specific points that I would like to leave you with. Clearly we will need innovation on all fronts. We will need financial innovation. That is already oc-

curing because no single investment structure will fit the requirements of this diverse market.

We certainly need policy innovation, and we need policy innovation to spur technological innovation both domestically and in the international arena. We need policies to be clear, to be unambiguous, to apply over a time scale that counts, and they need to be mandatory, legal and enforceable, and these are policies that will benefit both energy security and climate change.

I will just say a few things about promoting clean energy and energy efficiency technologies. I think the chairman's bill makes mention of a major scope to expand Federal programs that promote clean energy exports and technology partnerships. Many of these programs that currently exist are sadly underfunded and very few of the provisions of the Energy Policy Act of 1992 have been implemented, owing to a lack of Federal funding.

I think we have a huge opportunity here to improve our competitiveness in these technologies in the international arena. I would say there is an opportunity here for USAID, where I formerly served as Senior Science and Energy Advisor, for our foreign commercial services particularly in India and China, and with programs at OPEC and EXIM. It is clear that Federal programs of this kind can work because we already engage key countries and regions and create private/public partnerships, and Congress could increase their chances of success by creating incentives for companies to enter new markets and authorizing additional resources. As I said earlier, Citigroup has already announced the creation of its own \$50 billion investment fund for these technologies.

Finally, I think we should also focus on adaptation. General Anthony Zinni and a group of other generals and senior military personnel issued a report which I am sure you are all familiar with called National Security and The Threat of Climate Change, indicating that climate change, national security and energy dependence are a related set of global challenges, and that climate change acts as a threat multiplier for instability in some of the most volatile regions of the world, and that unless we take action in Asia where hundreds of millions of people rely on waters from vanishing glaciers, about 40 percent of the population of Asia, nearly 4 billion people, live within 45 miles of the long coastline and are in danger from sea level rise.

The location and topography of a country like Bangladesh makes it one of the most vulnerable countries in the world to sea level, and the specter of hundreds of millions of refugees is something that the generals are certainly taking very seriously, both in Asia and in sub-Saharan Africa. Sub-Saharan Africa is one of the most vulnerable areas in the world to sea level rise, climate change, desertification, crop failures, and the possibility of migration across the Mediterranean.

So we face daunting problems, new and difficult problems in our foreign aid and foreign policy. We need to re-engage with the international community in a constructive way, focusing on not just the 2 billion at the top of the pyramid but also the 4 billion people at the bottom of the pyramid who could be the markets of tomorrow. Finally, I think leadership requires a vision of where we want to go as a nation, taking strong domestic action that stabilizes the cli-

mate of our planet and assures energy and economic security for the entire world. This is a goal worthy of the United States, and Congress has an important role to play in reestablishing American leadership, in clarifying our national and international policy and in persevering long enough to show results. Thank you.

[The prepared statement of Mr. Jhirad follows:]

**STATEMENT OF DR. DAVID JOHN JHIRAD
VICE-PRESIDENT FOR SCIENCE AND RESEARCH
WORLD RESOURCES INSTITUTE**

**TESTIMONY SUBMITTED TO THE
COMMITTEE ON FOREIGN AFFAIRS
U.S. HOUSE OF REPRESENTATIVES**

**HEARING ON
U.S. RE-ENGAGEMENT IN THE GLOBAL EFFORT TO
FIGHT CLIMATE CHANGE
MAY 15, 2007**

Mr. Chairman and distinguished members of the Committee, good morning and thank you for inviting me to testify about a matter of compelling national and global significance. I am David Jhirad, Vice-President for Science and Research, of the World Resources Institute.

The World Resources Institute provides analysis and builds practical solutions to the world's most urgent environment and development challenges. We work in partnership with scientists, businesses, governments, and non-governmental organizations in more than seventy countries. For over 25 years, the World Resources Institute has provided information, tools, and analysis to address climate change and the degradation of ecosystems, while working to improve people's lives.

An Opportunity for US Leadership and Multi-faceted Innovation

According to the International Energy Agency (IEA), the world has embarked on an energy path that is incompatible with achieving a stable climate for the Earth and its people. The IEA also confirms that the international community is following an energy trajectory that is financially and economically unsustainable, and poses serious threats of regional and global conflict.

The United States and the international community are faced with daunting challenges in transforming this situation. Long-term solutions will require: stabilizing greenhouse gas concentrations in the atmosphere at acceptable levels; enhancing energy security and reducing the risk of economic and political disruption; eliminating energy poverty for over four billion people on the planet; and mobilizing over \$20 trillion in capital investment for energy infrastructure by the year 2030, mostly from private sources.

Visionary and sustained political leadership, international co-operation, and multifaceted innovation will be needed to implement transformational solutions. Innovations on a truly breathtaking scale will have to occur in policy, technology, and investment to assure global security and sustainability. Energy technology innovation and deployment on an

unprecedented global scale, amounting to a new industrial revolution, will be a vital and necessary part of the solution.

The End of the Scientific Debate and Calls for Action

In February 2007, the Intergovernmental Panel on Climate Change (IPCC) released its report on climate change science. The report states that it is “unequivocal” that the Earth’s climate is warming, and confirms that the current atmospheric concentration of carbon dioxide and methane, two important greenhouse gases (GHGs), “exceeds by far the natural range over the last 650,000 years.” Further, the IPCC concludes that it is now “very likely” (greater than 90% probability) that greenhouse gas emissions from human activities have caused “most of the observed increase in globally averaged temperatures since the mid-20th century.”

While any level of warming may have consequences, many scientists believe we must limit global warming to no more than 2 degrees Celsius above current levels to avoid the worst impacts of climate change. To limit global warming to less than 2 degrees Celsius, atmospheric carbon dioxide concentrations must not exceed 450-500 parts per million (the current level is approximately 380 ppm and rising at more than 2 ppm per year). To achieve this, global emissions would need to decrease dramatically during this century, on the order of 60 to 80 percent below current levels.

To underscore the validity of the science, a declaration issued jointly by the Academies of Science of Brazil, Canada, China, France, Germany, India, Italy, Japan, Russia, UK, and USA in 2005, stated,

“The scientific understanding of climate change is now sufficiently clear to justify nations taking prompt action.... We urge all nations, in the line with the UNFCCC principles, to take prompt action to reduce the causes of climate change, adapt to its impacts and ensure that the issue is included in all relevant national and international strategies. As national science academies, we commit to working with governments to help develop and implement the national and international response to the challenge of climate change.”

The scientific debate is largely over on the cause of global climate change – the focus has turned to action. It is essential that the United States take strong action at the national level to reduce emissions. The rest of the world cannot solve this problem without the U.S. Action by the U.S. will make clear that in tomorrow’s markets there will be a price for carbon, and will give U.S. companies an advantage in preparing to compete in those markets.

That is why twenty-one leading U.S. businesses including large energy consumers and customers such as General Electric, AIG, Alcoa, Caterpillar, DuPont, John Deere, Duke Energy, and General Motors joined with WRI and five environmental organizations to urge Congress to enact mandatory measures to “slow, stop and reverse” the growth in U.S. GHG emissions. The United States Climate Action Partnership (US CAP) on

January 22, 2007, issued “A Call for Action” which provided recommendations to Congress and the Administration on mandatory, economy-wide policy design to achieve emissions reductions of 60-80% by 2050.

Exemplary Action by the United States

Effective and credible leadership by the United States in the international arena demands that we implement strong federal legislation that captures the twin benefits of reduced petroleum consumption and greenhouse gas emissions. This will allow the U.S. to play a more constructive role in international fora, to enhance existing and to create new bilateral and multilateral arrangements, and to develop partnerships that engage the private sector in global emission reduction opportunities, both domestically and internationally.

Establishing a price for carbon in the United States through significant mandatory legislation will improve our stature in the international arena, and will build the credibility of U.S. institutions and companies throughout the world. A price on greenhouse gas emissions can lead to changes in consumer choices, corporate behavior, and new investment. A large problem historically has been our failure to use markets to define the value of energy security. If it is worth a dollar a gallon or more of a subsidy for replacing oil with ethanol, then that dollar should be a tax on all oil products, and not just on gasoline. Other countries such as Sweden charge an oil security fee for their strategic reserve, whereas ours is subsidized.

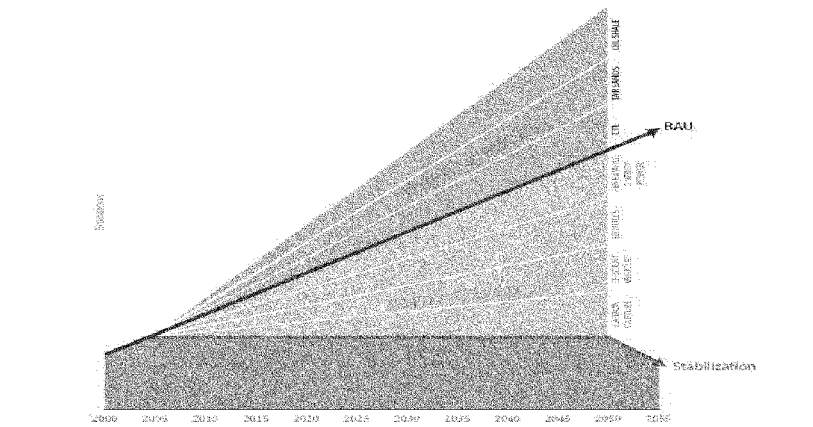
We know how to create markets – and make them work. This is a vital starting point if we are to re-engage the rest of the world. It is also an important step because the scale of the greenhouse gas reductions required is enormous. The world needs to reduce long term emissions by 60 to 80% from energy, transport, industries, agriculture, and land use.

The solution is to catalyze a massive transformation in energy technology development and deployment, both in industrialized and in developing economies. The drivers for this transformation are straightforward: **government policy and private sector investment**. Most importantly, the transition of the energy sector to a diversified, low-carbon system offers an opportunity to research, develop, and manufacture advanced technologies that will clean the air, improve people’s health, and provide greater economic and political security and stability.

A paper published by the journal *Science* by two Princeton researchers in 2004 demonstrated graphically how a suite of existing technological options could be used to reduce GHG concentrations to a level that is sufficient to avoid the most dangerous effects of climate change. They illustrate this point by breaking the required emission reductions down into manageable (though still large) “wedges,” each provided by a different technology or set of technologies. At WRI, we have modified this very useful concept to include an indication that not all energy choices will yield emissions reductions – in fact, our analysis shows that some of the potentially appealing political choices to enhance energy security could have significant negative impacts on

greenhouse gas emissions. Figure 1 offers a visualization of this modified wedges concept.

Figure 1: Smart Wedges and Threat Wedges



Source: World Resources Institute

As the figure illustrates, the concept is based on the comparison of a business as usual (BAU) projection of GHG emissions into the future with the desired trajectory of stable global emissions through the year 2050. The triangle-shaped gap between the two lines can be divided into smaller portions, each of which represents a technology option. The paper presented 15 such options, each with the potential to reduce emissions in 2050 by one gigaton of carbon per year, and argued that implementing only 7 of these would be sufficient to avoid the worst effects of climate change.

However, the range of policy and technology choices available that are not included in BAU assumptions includes a number of options that could *raise* emissions significantly. These are likely to be driven particularly by energy security concerns and/or consistently high oil prices, and include:

- Production of synthetic liquid fuels from coal (known as coal-to-liquids, or CTL),
- Extraction of heavy oils from so called “tar sands,” and
- Production of oil from crushed rocks called “oil shale.”

Considering oil security issues in isolation, these options offer some advantages: although high-cost, they depend on fuels that are available in abundance in countries such as the United States and Canada. However, from a climate perspective they represent a serious threat. CTL gives rise to roughly double the emissions of oil-based fuels, and both tar sands and oil shale require significant quantities of energy and water to process.

Extensive application of one or more of these technologies could have fatal effects on efforts to limit climate change. We term these “threat wedges” to contrast with the “smart wedges” of the Princeton work.

This visual illustration conveys a simple, powerful idea: that, despite the scale of the problem, we have the potential to solve it if we can deploy today’s technologies at sufficient scale. The wedges approach offers us a way of coming to grips with the problem of taking technologies to scale, and raises questions that are vitally important for both policy makers and private sector actors. How are such wedges to be realized in national policy? What are the needs in terms of technology, capital, market actors, and regulatory environment? How do we move from today’s market and legislative conditions to those appropriate to the enormous task of realizing a wedge?

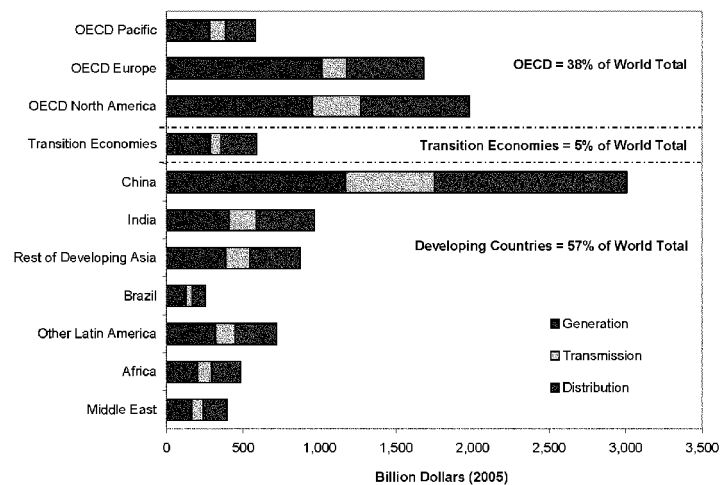
The International Dimension

When we look at the international level, the list of questions gets longer. How can the wedges concept fit within the development plans of developing countries? What is the balance between in-country policy and international mechanisms in bringing these wedges to market? How can the governance and decision making structures within developing countries lead to smarter and cleaner investment choices? How can developed countries work with India and China to bring wedge technologies to market?

If greenhouse gases are not an immediate concern in countries such as India and China, energy issues are. A rush for investment, energy security concerns, and the staggering cost of pollution in terms of human life all make clean, efficient technologies highly desirable in the developing world, as elsewhere. Both Indian and Chinese energy markets are dominated by domestic capital resources, and both tend to strongly favor high-end technology.

There is considerable scope to engage both private sector and government players in the promotion of clean technology markets. Just as for most technologies, this will no longer be a question of isolated countries but of global markets serving national demands. Because India and China are large and growing energy consumers in global markets, **there is a strong case to be made to include India and China as member countries, speaking from my own experience as the Vice-Chairman of the Governing Board of the International Energy Agency.**

There is also an international dimension to capital flows to low carbon technologies. Layered on top of the country-specific aspect of capital investment is the network of investment players that can support large scale deployment of technology. In China, for instance, the vast majority of capital deployed in the energy sector is domestic, and much is not constrained by the same requirements for return on investment as in more liberalized markets. According to the *World Energy Outlook* the largest investment requirements in the power sector, some \$3 trillion, will occur in China.

Figure 2: Cumulative Power Sector Investment by Region, 2005-2030

Source: IEA, *World Energy Outlook, 2006*

While the majority of capital invested in these countries is domestic, the sovereign risk characteristics of these countries can differ significantly, which can influence the types of international lenders that are willing to invest in these markets. This aspect of investment risk, combined with the technological capacity of a country to deploy technologies, as well as the local policies and measures that govern them, can influence technology investment flows to Brazil, Russia, India, and China.

Financial Innovation

While it would be easy to suggest that greater policy certainty will drive more investment flows into wedge technologies, total regulatory certainty is often not feasible. Financial innovation is required as part of the broader design of policies and institutional structures framed for wedge implementation.

Just as there is no technological silver bullet, there is no single investment structure that would fit the requirements of this diverse market. Because different segments of the financial community can support different levels of risk, a range of custom-designed instruments will be required in order to finance low carbon technology deployment. This could include targeted policies to promote low carbon exports, as public resources alone will certainly not prove sufficient to meet all the financing requirements. There needs to be a degree of cooperation between players in international capital markets that goes beyond traditional pools of capital.

Policy Innovation

Investment on the scale required to implement the climate wedges can only be mobilized with an adequate policy framework. Accordingly, public policy will be critical in enabling providers of technology and capital to establish working markets.

At the same time, investors and technology providers will have to work in the absence of clear policy, at least in some parts of the world. Climate change is so pervasive that its policy drivers will inevitably overlap with those in other policy spheres, such as energy, security, agriculture, and development. Understanding how these policies will emerge and interact is vital to successful low-carbon technology deployment.

To be effective and to spur technological innovation, a policy framework must provide incentives to invest in cleaner technologies, such as regulatory mandates, prices, or taxes. In addition, it must reduce investor risk by providing clear, reliable signals over timescales that allow adequate returns on investment.

- The policies need to be clear and unambiguous. This argues for simplicity and a minimum of bureaucratic detail. It also means that the political leadership behind the policies needs to be clear and credible, to create confidence that policy direction will be maintained.
- Policy signals need to apply over a timescale that counts. Too short, and they do not provide enough confidence among investors that they can plan for adequate returns.
- Policies only give clear signals if they are mandatory, legal, and enforceable. By themselves, voluntary measures are unlikely to be significant drivers of the wedges, because so many of the technology responses, at least in their early stages, entail additional costs. The scope of companies to adopt more costly options while their competitors are not obliged to do so is inevitably limited.
- Price signals may emerge gradually, and take time to command investor confidence. For some technology options, there may be a role for government research and development support to bring new technologies to the point where carbon prices set by policy are sufficient to let the market take over.

Energy security is high on the political agenda, pushed by both fuel prices and geopolitical concerns. For technologies such as renewable energy and efficiency improvements, the policy responses to energy security concerns complement the “smart” climate wedges. However, energy security is also the main driver behind the “threat” wedges that could divert major effort in technology and capital into making the climate problem worse.

Agriculture policy has dominated biofuels policy, particularly in the United States and Europe, and will continue to have an important role. From an energy perspective this means that sub-optimal methods for producing biofuels, in particular the use of starch-based crops, will continue to attract public support disproportionate to their actual energy benefits.

Trade issues are of great importance, given the international scale of wedge deployment. Countries apply tariffs to trade in technologies and services that can impede investment. Related issues such as intellectual property protection and the liberalization of domestic energy markets are also critical and will be shaped by political considerations wider than even the wedges vision.

Many different policy approaches *could* be taken to advance selected wedges. Any or all of these might be applied in different jurisdictions, though many of them may be far from optimal. Policy approaches such as cap-and-trade and carbon taxes are not mutually exclusive. In addition, policy design does not start from scratch. Where existing policies such as vehicle efficiency standards, renewable energy portfolio standards, or biofuels subsidies exist there will be a strong preference for incrementally improving those policies over designing fundamentally new ones, unless there is a strong consensus that existing policies have failed.

Investors in any wedge technology should expect to encounter any or all of these policies in the countries in which they operate. For instance, the sale of efficient vehicles at present is affected in the U.S. by performance standards (CAFE) and technology support (e.g., HOV lane rights for hybrid vehicles); in Europe by voluntary agreements (ACEA), fuel taxes (all member states), and congestion charging (London); in China by performance standards; in India by mandates (compressed natural gas for public vehicles in Delhi); and so on. While some wedges (particularly those in the power sector) will be more likely than others to get a straightforward price signal through a cap-and-trade system, many such proposals currently in the U.S. Congress also cover transport fuels. The variety of policy tools is the likely permanent state of any market.

Promoting Clean and Efficient Energy Technologies in the International Arena

The European Union has acted on the realization that the clean technologies of the future require domestic policies that create private investment and innovation. So Germany and Denmark have overtaken the U.S. on solar and wind electricity respectively. Not just in terms of the installed megawatts of power generation, but in terms of employment generation, economic benefits and a globally competitive industry.

There are now 26 companies and NGOs in the US Climate Action Partnership asking for mandatory climate policy in the U.S., because they know that to compete in global markets tomorrow they need clear and mandatory policy today. The U.S. needs to be competitive in the global marketplace for clean energy. This market will develop whether or not we participate. The key issue for the U.S. is whether it will lag behind its competitors, as it has done for many of the telecom and automotive innovations that were developed in the U.S. but built elsewhere, or whether the U. S. will be a market leader in the energy revolution of our millennium, with the creation of wealth that flows from such leadership.

There is major scope to expand Federal programs that promote clean energy exports and technology partnerships. For a world in which global energy investments will exceed \$20 billion over the next twenty-five years, U.S. efforts have been grossly under-funded. The U.S. investment in new technology initiatives, such as the US Methane to Markets Program, the Carbon Sequestration Leadership Forum, and the International Partnership for a Hydrogen Economy, is much too small to have any impact. Very few of the provisions of the Energy Policy Act of 1992 have been implemented owing to a lack of Federal funding. In particular, the Interagency Working Group to support a Clean Energy Technology Exports Initiative, has not yielded important outcomes.

The United States Agency for International Development (USAID) needs to ramp up considerably its policies and programs that promote clean energy technologies. Programs need to focus on developing markets for such technology, through improving policy and regulatory frameworks, and removing barriers to private investment. An example of a successful promote clean and efficient energy technologies in developing counter programs, now ended, was FINERCA-Financing Renewable Energy in Central America. The market development activities implemented via this program were a key component of the increased investment activity now taking place in the region. The modest \$5 million in technical assistance, business development, policy and targeted training interventions leveraged over \$70 million of new capital to the sector. There is a crying need for this type of market development program in other renewable energy and efficiency markets.

For countries such as India and China, the Foreign Commercial Service needs to build its knowledge of US technologies, investors and companies in order to engage effectively with markets and joint-venture partners in these countries. Such engagement could be enhanced considerably through trade and reverse-trade missions in clean energy technology. Currently, such programs are under-staffed and resourced.

The Overseas Private Investment Corporation (OPIC) and the Export Import Bank (EXIM) should collaborate actively with U.S. companies seeking to invest in clean energy technologies in emerging markets, and provide an array of incentives for such investments.

There is a persuasive argument for a funded mechanism in the Executive Branch to ensure the coherence and effectiveness of government programs that promote the use of clean energy in international markets. Accountability and “management for results” should form the core values this initiative.

It is clear that Federal programs of the kind proposed can work. They already engage key countries and regions, and create private-public partnerships that are vital in developing successful commercial markets in clean technology. Congress could increase their chances for success by authorizing additional resources, and by creating incentives for companies to enter new markets. Congress can also provide a framework so that the large-scale private capital and investment community is actively engaged. (Citigroup recently announced the creation of a \$50 billion fund for low carbon investments).

Climate Change and Security Impacts: Opportunities for Foreign Policy Leadership

The U.S. global effort will also need to focus on adaptation. Unfortunately, it is the poorest and least able to cope with climate change, which will be most significantly affected; we need solutions that address this reality. The array of U.S. foreign assistance and foreign policy agencies will need expertise in security to help navigate the impacts of climate change on developing countries. But the U.S. cannot act unilaterally, and will need to work collaboratively with all industrialized and developing countries.

As the recent IPCC report points out, there are uncertainties as to the timing and magnitude of impacts. But we have enough certainty to correlate these events with their policy/security implications. Our systems of governance, including everything from individual nation-states to multinational systems, including finance and trade, all operate within tolerances. Climate change is increasingly a critical dimension of those tolerances, and we need to take it into account as a driver in the viability of all international systems. Beyond a certain level of change, it can be argued reasonably that climate change impacts become a profound challenge to the foundations of the global, industrial civilization

As pointed out by the recent report by a group of generals and senior military personnel, “National Security and the Threat of Climate Change,” climate change, national security, and energy dependence are a related set of global challenges. Climate change is projected to compound the pressures on natural resources and the environment associated with rapid urbanization, industrialization, and economic development.

Climate change acts as a threat multiplier for instability in some of the most volatile regions of the world. The above report states that, “Unlike most conventional security threats that involve a single entity acting in specific ways at different points in time, climate change has the potential to result in multiple chronic conditions, occurring globally within the same timeframe. Economic and environmental conditions in already fragile areas will further erode as food production declines, diseases increase, clean water becomes increasingly scarce, and populations migrate in search of resources.”

Asia, where hundreds of millions of people rely on waters from vanishing glaciers on the Tibetan plateau, could be among the hardest hit regions. Almost 40 percent of Asia’s population of nearly 4 billion lives within forty-five miles of its nearly 130,000-mile-long coastline. Sea level rise, water availability affecting agricultural productivity, and increased effects of infectious disease are the primary climate impacts expected to cause serious problems in Asia. With higher sea level, coastal regions would also be subject to increased wind and flood damage due to storm surges associated with more intense tropical storms. (The number and intensity of strong cyclones has increased since 1950s; 21 extreme storm surges occurred over the period 1950-2004, of which 14 occurred during 1986-2004.)

Climate change related melting of glaciers could seriously affect a half billion people in the Himalaya-Hindu-Kush region and a quarter billion people in China who depend on

glacial melt for their water supplies. As glaciers melt, river runoff will initially increase in winter or spring but eventually will decrease as a result of loss of ice resources. Consequences for downstream agriculture, which relies on this water for irrigation, and on livestock, will be unfavorable.

The location and topography of Bangladesh make it one of the most vulnerable countries in the world to a rise in sea level. Situated on the Bay of Bengal, it has a population of almost 150 million, and has a coastline exceeding 300 miles. About 10 percent of Bangladesh is within three feet of mean sea level. Over the next century, population rise, land scarcity, and frequent flooding coupled with increased storm surge and sea level rise could cause millions of people to cross the border into India. Migration across the border with India is already such a concern that India is building a fence to control illegal immigration.

According to the report, "National Security and the Threat of Climate Change," climate change will also significantly contribute to existing tensions in the African continent. It can facilitate weakened governance, economic collapses, massive human migrations, and potential conflicts, and could place heavy demands on international military forces. The challenges Africa will face as a result of climate change could present serious threats to even the most stable of governments. As climate changes and agricultural patterns are disrupted, with reduced rainfall and increasing desertification of the sub-Saharan region, migrations to Europe and within the African continent will undoubtedly increase. Sea level rise could also result in the displacement of large numbers of people on the African continent.

Our foreign aid and security assistance agenda will face new and difficult problems, and the U.S. will need to re-engage with the international community in a constructive way on both mitigation and adaptation. We currently focus on the 2 billion people at the top of the global economic pyramid, but we also need to serve the 4 billion at the base of the pyramid who could be the markets of tomorrow.

Leadership requires a vision of **where** we want to go as a nation. Taking strong domestic action that stabilizes the climate of our planet and assures energy and economic security for the entire world is a goal worthy of the United States. Congress has an important role to play in re-establishing American leadership, in clarifying our national and international policy, and in persevering long enough to show results.

Mr. GREEN. Dr. Montgomery.

**STATEMENT OF W. DAVID MONTGOMERY, PH.D., VICE
PRESIDENT, CRA INTERNATIONAL**

Mr. MONTGOMERY. Thank you, Mr. Chairman and members of the committee. I appreciate your invitation. I am David Montgomery. I am Vice President of CRA International. I would like to mention that I am solely responsible for my testimony today, and it does not necessarily represent the position of either CRA International or any of our clients. I will summarize my testimony. I would like to request that my longer statement be entered into the record.

It is my opinion that the Kyoto protocol is a flawed approach to global action on climate and with or without the United States it is unlikely to achieve anything close to the goal of stabilizing greenhouse gas concentrations in an acceptable range. As my prepared statement discusses in more detail, many students of international agreements have pointed out that the unenforceability of the Kyoto protocol makes its stability in the long term doubtful. In addition, it fails on the two highest priorities of climate policy. It cannot stimulate the technological advances that are required to make stabilization of temperatures affordable, and it is not engaging developing countries sufficiently to make a difference.

Mandatory U.S. greenhouse gas controls in any version of the Kyoto protocol would impose a significant cost on the U.S. economy. In previous studies looking at a range of proposals for U.S. emission caps, my colleagues and I have estimated annual losses that would range from about $\frac{3}{10}$ of a percent of GDP to almost 2 percent of GDP in 2020, depending on which of the bills that is now under consideration might be adopted.

By raising the cost of U.S. industry, mandatory controls would also lead to a shift in investment away from the United States and toward countries like China and India that are not willing to undertake similar efforts. By creating these competitive advantages, adherence to the Kyoto protocol by industrial countries will actually strengthen the incentives for countries like China and India to resist controls.

Once China and India build industries that depend on a difference in energy cost to succeed, it will become politically even more difficult for their governments and others in the same position to undertake policies that threaten those interests. Thus far from providing a moral example that will bring countries like China into an international agreement, naive unilateral action can create economic disincentives for those countries to limit their emissions.

Because China and India and other developing countries will be responsible for the majority of global emissions over the next century, any prospect for halting global warming depends crucially on inducing them to cut their emissions. Even if industrial countries achieve zero emissions by 2035, unless the developing countries followed suit global emissions would continue to rise and stabilization of concentrations would be impossible at any level.

Nevertheless, there is an immense potential for cost effective emission reductions in developing countries. However, at this point

institutional and market failures in those countries and governance issues like the ones we see about China's introduction of melamine into wheat gluten make it highly unlikely that efficient market based policies will be effective in those countries. My conclusion is that the potential for low cost emission reductions in developing countries can be unlocked only if those countries adopt the deep institutional reforms that are necessary for the efficient functioning of markets and sustained economic growth.

Some reform of this kind has triggered the economic growth in China and India. A great deal more is necessary in order to make it possible for them to implement policies as efficiently and effectively as many assume.

Designing an international agreement that can lead to institutional reform will be difficult because such reform has proven difficult throughout the world and is opposed by powerful interests in China and India. I think the greatest view S contribution in international engagement would be to convince the rest of the world to recognize and confront these difficulties in a realistic way.

Designing an international agreement that can lead to cooperative R&D, technological advance and technology transfer, on the other hand, is quite feasible. To be effective I believe that negotiations for a post 2012 agreement should be removed from the U.N. Framework and confined to the top say 13 to 20 countries in total emissions.

As Ms. Claussen mentioned, these countries cover 75–80 percent of global emissions, and the agenda should include cooperative R&D, mechanisms to address institutional change, investment climates in developing countries, and technology transfer. I also agree with Ms. Claussen that the ultimate objective of stabilizing greenhouse gas concentrations at some level needs to be kept in line but it is pointless to negotiate specific concentration goals until a framework conducive to technological advance and developing country participation is created.

There is no point in discussing at great length or setting infeasible goals, and we do not what is feasible until we know what we can do on technology and getting the developing countries involved. The experience of the Kyoto protocol does suggest to me a few guiding principles for a realistic and effective architecture.

First is avoid creating perverse incentives. This has been one of the clearest failings of the Kyoto protocol. It encourages developing countries to stay out. It does not provide any incentive for countries to stay in, and it is the design of one process for involving developing countries. The CDM has proved vulnerable to gaming.

I think I am making a similar recommendation to Ms. Claussen which is that to create an effective agreement in which parties have an incentive to live up to their commitments we need some form of pledge and review to replace targets and time tables. This involves a discussion of concrete actions that can be monitored effectively and have credible consequences for failure.

I also think it is important for us to be clear about our broader foreign policy objectives in these negotiations and focus benefits on those in need. A global emission trading regime would require massive wealth transfers to convince China to join under current circumstances and provide almost nothing to the poorest countries. I

think there are legitimate arguments that the industrial countries should bear the cost of protecting the poorest but it is difficult to see why we have any moral obligation to pay China to participate.

A focus on institutional change in these negotiations to make it possible for developing countries to reconcile growth with a clean environment would not only benefit China but it would also aid the poorest by helping put them on a path to sustained and environmentally sound economic growth. I would also suggest we concentrate on the highest priorities first. I think that for the industrial countries that priority has to be cooperative approaches to technology development. Technology does not exist today that would allow us to stabilize greenhouse gas concentrations globally in an affordable cost, and cooperative technology R&D can contribute to solving that problem.

For negotiations with developing countries, the focus should be on promoting institutional change that will create efficient markets and a favorable investment climate that can reconcile economic growth with lower emissions. Timing of reductions in emissions from industrial countries needs to be paced by both technology and development country participation to avoid getting ahead of what can be afforded and to avoid creating undesirable incentives for the developing countries to lag behind.

And my final point would be to reiterate that in answer to your question about the Framework Convention, I think little is going to come out of negotiations that have to involve nearly 200 parties, most of them having primary agendas completely unrelated to climate change and that getting out from under the this process, dealing with the big emitters, 13 is a number that has been picked because that gets Australia into it, something between 13 and 20 is probably feasible, and I think it could be complimented with a regional and bilateral discussion such as the Asia Pacific partnership and the United States-India strategic partnership which can supplement these negotiations and actually provide examples of how to achieve effective engagement with developing countries. Thank you, Mr. Chairman.

[The prepared statement of Mr. Montgomery follows:]

**Prepared statement of
W. David Montgomery Ph.D.
Vice President, CRA International
before the
Committee on Foreign Affairs
U.S. House of Representatives
May 15, 2007**

Mr. Chairman and Members of the Committee

I am honored by your invitation to appear today, as the Committee addresses how the United States could most effectively engage in international action to manage the risks of climate change. I am Vice President of CRA International, co-head of CRA's global energy and environment practice, and an economist by profession and training. Much of my work for close to 20 years has dealt with the economics and policy of climate change, on both the national and international level. Most recently my research and publications have focused on design of policies that can most effectively stimulate technology innovation and reduce or reverse the growth in emissions from developing countries. My statements today are my personal conclusions and opinions, and do not necessarily represent positions of CRA International or any of our clients.

Key Points

My testimony contains eight key points.

- The Kyoto Protocol is a flawed approach to global action on climate, and with or without the United States is unlikely to achieve anything close to the goal of stabilizing greenhouse gas concentrations in an acceptable range.
- Mandatory U.S. greenhouse gas controls and any version of the Kyoto Protocol will impose a significant cost on the U.S. economy and will lead to a shift of investment away from the U.S. and toward countries like China and India that are not willing to undertake similar efforts.
- By creating these competitive advantages, adherence to the Kyoto Protocol by industrial countries will actually strengthen the incentives for countries like China and India to resist controls.
- Because China, India and other developing countries will be responsible for the majority of global emissions over the next century, any prospect for halting global warming depends crucially on inducing these countries to cut their emissions.
- The immense potential for cost-effective emission reductions in developing countries can only be unlocked if those countries adopt the deep institutional

reforms that are necessary for the efficient functioning of markets and sustained economic growth.

- Designing an international agreement that can accomplish this will be difficult, and the greatest U.S. contribution would be to convince the rest of the world to recognize and confront those difficulties in a realistic manner.
- A new framework is needed to replace the Kyoto Protocol. To be effective, negotiations for a post-2012 framework should be confined to the top 13 to 20 emitting countries. The framework should include cooperative R&D and mechanisms to address institutional change, investment climates, and technology transfer in the rapidly growing developing countries.
- Although the ultimate objective of stabilizing greenhouse gas concentrations at some level needs to be kept in mind, it is pointless to negotiate specific concentration goals until a framework conducive to technological advance and developing country participation is created.

Costs to the U.S. economy

Mandatory U.S. greenhouse gas controls and any version of the Kyoto Protocol will impose a significant cost on the U.S. economy and will lead to a shift of investment away from the U.S. and toward countries like China and India that are not willing to undertake similar efforts.

Any industrial country that sets a mandatory cap on carbon dioxide emissions will have to incur higher energy costs to meet that cap. The tighter the cap, the greater that cost will be. In previous studies that have looked at a range of proposals for U.S. emission caps set at varying levels, we have estimated annual losses that range from 0.3% to about 1.9% of GDP in 2020.¹ For proposals that apply a constant or declining cap, or provide for a rising carbon tax, these costs would increase over time. In every case, we see exactly the same mechanisms at work. The need to adopt more costly methods of electricity generation, to invest in producing more expensive, low-carbon fuels and to undertake more intensive energy conservation measures diverts resources that would otherwise be available to produce the goods and services that make up GDP. Higher energy costs raise the costs of U.S. manufacturing relative to competitors in countries that do not adopt limits on greenhouse gas emissions.

Due to these higher energy costs, there will be an even greater shifting of investment from the United States (and other industrial countries) into countries like China and India. Emissions in the United States will fall, especially as our share of energy intensive industries shrinks, but they will grow even faster in China as factories rise there that would otherwise have been built here. Moreover, given the much lower level of energy

¹ Prepared statement of Dr. Anne E. Smith before the Committee on Energy and Natural Resources, United States Senate, Washington, DC September 20, 2005

efficiency in countries like China, the leakage of emissions will be much greater than the leakage of investment.

Deficiencies of the Kyoto Protocol

The Kyoto Protocol is a flawed approach to global action on climate, and with or without the United States is unlikely to achieve anything close to the goal of stabilizing greenhouse gas concentrations in an acceptable range. It gives developing countries inadequate incentives to participate, and even the industrial countries that ratified the Protocol are unlikely to meet their targets without resort to purchasing credits that are not backed by real reductions.

The failings of the Kyoto Protocol are unavoidable in any approach based on future targets and timetables. The complete lack of definition for targets beyond 2012 undermines any reasonable expectation that investments made today for the purpose of reducing future emissions would generate any predictable return. This problem cannot be fixed by getting started on negotiations for the Second Commitment Period, because the Protocol provides no enforcement mechanisms or other incentives to induce reluctant parties to sign the treaty and continue their participation in emission targets and timetables. This lack of enforceability stems not from poor drafting of the treaty, but from the fundamental fact that an agreement on future targets and timetables among sovereign countries is in principle unenforceable and therefore unstable.²

The Kyoto Protocol's fatal flaws were outlined succinctly by Professor Scott Barrett of Johns Hopkins SAIS. He wrote:

... The Kyoto Protocol has failed to create the incentives needed to promote global participation, to reduce emissions both substantially and in the long term, and to implement these reductions in a cost-effective manner. Moreover, it is difficult to see how the Kyoto approach could be modified to create the needed incentives. A different, more radical approach is required.

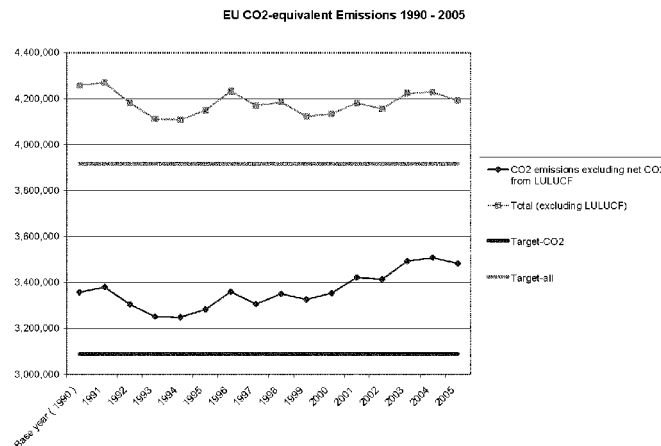
Sovereign countries are unable to make binding commitments, because the Protocol deals with targets rather than observed actions. Moreover, there are no consequences under the Kyoto Protocol for failure to participate or to comply with an agreed target. Any country can avoid its commitments *de jure* by withdrawing with two years notice, or *de facto* by rolling any violation of a target into future periods. The Kyoto Protocol fails to define emission targets beyond 2012, and negotiations on the Second Commitment Period (2013 – 2017) are just beginning.

² Scott Barrett, "U.S. Leadership for a Global Climate Regime," a paper done for the Climate policy Center, March 2003. Barrett's book *Environment and Statecraft: The Strategy of Environmental Treaty-Making*, Oxford University Press, 2003 provides a clear and complete exposition of how the lack of enforcement and participation incentives leads to the ultimate breakdown of the Kyoto Protocol and failure to motivate effective action.

The only enforcement provisions in the Protocol provide that any failure to meet a target in a given period must be made up with a penalty in a future period. However, the lack of definition of targets beyond the first commitment period makes these penalties meaningless. No country that is likely to be in violation of its first commitment period target needs to agree to a second commitment period target, until that second target is increased sufficiently to avoid the penalty. Since no commitments are defined for any future period, any country that expects to exceed its target can negotiate a sufficiently high future commitment to cover the excess, without requiring any real action to make it up. A country that wishes to do so is in a good bargaining position, because its fallback is to withdraw completely. In short, **the hard caps of the Protocol become soft when violations can be rolled into yet-to-be-negotiated future targets.**

By lurching from one short run goal to the next, the Kyoto process gives countries (and their industries) no credible expectation that there will be stable, progressively more ambitious future commitments. Therefore it creates no incentive to make large investments (in R&D or different energy supplies) that will only pay off if the agreement holds together.

Thus it is not surprising to see that even the EU and Japan are not achieving the emission reductions required to meet their targets through domestic action. The figure below shows the lack of progress made by the EU15 since they signed the Kyoto Protocol in 1997. Their CO₂ emissions have risen, and only one-time success in controlling non-CO₂ greenhouse gases has held total greenhouse gas emissions constant. Both levels remain far above the targets to which the EU15 agreed. A similar picture characterizes Japan.



Source: Data submitted by the EU to the UNFCCC; units are in 1000 metric tons CO₂ equivalent

Reports for the EU25 appear to show more progress, but this is only because the entry of Eastern European countries into the EU has given the original 15 EU members the benefit of emission reductions already achieved by their new members. Thus data for the EU25 obscure the inability of the original EU parties to the Kyoto Protocol to meet their reduction targets.

Both the EU and Japan intend to rely on purchasing credits from CDM or Russian “hot air” to meet their obligations. Credits from Russia are simply a way of buying out of the obligation, since they are the ‘hot air’ that Russia skillfully extracted as a condition of agreeing to the Protocol, and represent no actual emission reductions.

CDM was intended to provide a mechanism under which the Kyoto parties could fund real emission reductions in developing countries when those opportunities are more cost-effective than domestic reductions. The CDM, however, is not working out that way. Rather than engaging the developing countries in reducing emissions, CDM is encouraging them to game the system and increase emissions so that they can subsequently get credit for reducing them. Thus reliance on CDM may also replace real emission reductions with credits that represent no real reduction from what would have happened without the Kyoto Protocol. The unintended consequences of the CDM have received considerable attention in the press recently.

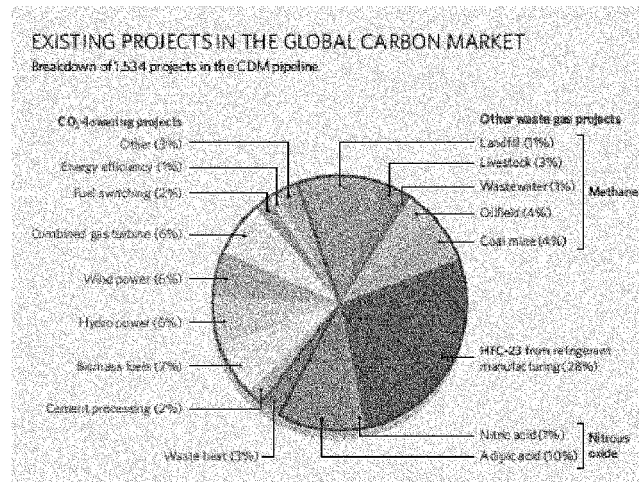
Contrary to expectations when the CDM was created, relatively few of the credits have been generated from projects involving new energy sources or long term improvements in energy efficiency. Rather, they have been concentrated in non-CO₂ greenhouse gases that provide very large amounts of credits because of their exceptionally large effect on global warming (see figure below). Although there is no question that releases of these gases must be stopped, the CDM rules have not always led to true reductions.

According to Michael Wara of Stanford University:

The CDM fails as a market because it has animated accounting tricks that allow participants to manufacture CERs at little or no cost.

...there is relatively strong evidence that HCFC-22 producers participating in the CDM have behaved strategically to direct a greater share of the subsidy to themselves by artificially inflating their base year production...”³

³ Measuring the Clean Development Mechanism’s Performance and Potential Michael Wara
Working Paper #56 July 2006 The Program on Energy and Sustainable Development at Stanford University



Source: Michael Wara, Is the Global Carbon Market Working, *Nature*, Vol 445, No. 8 February 2007

More recently, the British *Sunday Times* reported that

“While British companies use the credits instead of cutting their own pollution, [the seller of emission credits from burning CFCs] plans to reinvest its windfall in building a new plant producing another refrigerator gas called HFC-134a - 1,300 times more damaging than carbon dioxide.”⁴

Technology and developing countries are key to managing climate risks

Technology innovation and participation by developing countries are indispensable to managing climate risks at an acceptable economic cost, and the approach of the Kyoto Protocol cannot accomplish either one.

New technological solutions are required to make stabilization an economic possibility

Technology innovation and participation by developing countries are both indispensable to managing climate risks at an acceptable economic cost. The Kyoto Protocol cannot accomplish either one nor could any approach modeled on Kyoto.

One of the clear implications of climate science is that stabilizing atmospheric concentrations of greenhouse gases will require the world (not just the U.S.) to reduce greenhouse gas net emissions to near-zero levels. – that is, the rate at which emissions are put into the atmosphere must equal the rate at which they are removed. That cannot be

⁴ From The Sunday Times, April 22, 2007 “Indians make cool £300m in carbon farce”

done at affordable cost with today's technology or with incremental improvements in that technology. Halting climate change is possible only if large-scale greenhouse gas emission reductions can be implemented at costs that are both politically and economically acceptable. Therefore, R&D to create new technological options is a necessity if that stabilization goal is to be economically feasible.

The challenge is huge. One study estimates that getting on a path toward zero net emissions will require that, within the next 50 years, the world must produce carbon free energy at twice the level of today's output of all energy.⁵ The magnitude of possible reductions in the next decade or two achievable with today's technology is dwarfed by the magnitude of reductions that are required and that successful innovation would supply. A massive program of R&D focused on breakthrough discoveries leading to new approaches and technologies is required. Even mandatory limits on emissions over the next decade or two will not provide a sufficient, credible incentive for that R&D.⁶

Hoffert *et al.* identify an entire portfolio of technologies requiring intensive R&D, suggesting that the solution will lie in achieving advances in many categories of research. They conclude that developing a sufficient supply of technologies to enable near-zero carbon intensity on a global scale will require basic science and fundamental breakthroughs in multiple disciplines. This kind of R&D effort appears to be the only way to hope to achieve meaningful reduction of climate change risks. Emission limits that do not simultaneously incorporate specific provisions that directly support a substantially enhanced focus on energy technology R&D will not effectively reduce climate risks.

Development and transfer of new technology is also critical to preventing increases in emissions from developing countries. Although significant, cost-effective emission reductions are possible in these countries in the near term with today's technology, ultimately their emissions will still grow rapidly unless new, low cost technologies are developed.

Climate risks cannot be managed without China, India and other large developing countries

Because China, India, and other developing countries will be responsible for the majority of global emissions over the next century, any prospect for halting global warming depends crucially on inducing these countries to cut their emissions. These countries are expected to continue rapid population and economic growth which, combined with essentially wasteful energy use, leads ultimately to emission far surpassing our own. China is a good example. Its rate of economic growth has exceeded 8% per year for the past decade, and every added dollar's worth of output in China increases greenhouse gas

⁵ M. I. Hoffert, et al. "Advanced Technology Paths to Global Climate Stability: Energy for a Greenhouse Planet" *Science*, Vol. 298, November 1, 2002, p. 981-7.

⁶ W. D. Montgomery and A. Smith, "Price, Quantity and Technology Strategies for Climate Change Policy," Chapter 27 in M. Schlesinger, H. Kheshgi, et. al, eds. *Human-Induced Climate Change: An Interdisciplinary Assessment*, Cambridge University Press, forthcoming 2007.

emissions by double the amount associated with a dollar's worth of output in the United States. Energy-related technology used in most of China still lags far behind the United States.⁷ Thus China's greenhouse gas emissions are expected to exceed ours within the next year or two, and to keep on increasing from there. India is a similar story, though at this time a smaller economy.

The Kyoto Protocol's inability to bring China and India within the system of mandatory emission reductions dooms the agreement, or any similar agreement to environmental ineffectuality. Even if all the countries that originally signed the Protocol were to meet those targets, the result would fall far short of what is required to stabilize global temperatures. MIT researchers have estimated that the Kyoto Protocol, if all its signatories were to continue forever to keep emission at or below its targets, would produce a reduction of 0.5° C in global average temperatures by 2100 (about a 14% reduction from uncontrolled temperatures).⁸ Other mainstream climate scientists have estimated that it would take 30 Kyotos to achieve what they consider acceptable concentrations of greenhouse gases in the atmosphere,⁹ and that the targets for the 2008-2012 period would reduce global average temperatures in 2050 by just 0.07° C.¹⁰

A few years ago researchers at MIT determined that to reach a commitment of holding CO₂ concentrations below 550 ppmv while allowing non-Annex 1 country emissions to grow unchecked, the OECD countries would, by 2035, have to reach *negative* emissions, i.e. net removal of greenhouse gases from the atmosphere.¹¹

All these estimates assume that parties to the Protocol actually meet their targets. It is not just the United States that will have emissions in excess of the Kyoto Protocol target. At this point, Australia, Japan, Canada, and the European Union itself appear likely to fail to reduce emissions sufficiently to meet their targets. The European Union may be able to comply with its obligation, but only if it purchases large quantities of "hot air" from Russia, an action which leads to no net decrease in global emissions.

This reality poses a fundamental dilemma for U.S. climate policy. On the one hand, America and the other OECD countries cannot solve the problem of climate change without the help of countries like China and India, and would incur serious economic costs in proceeding with GHG controls without the participation of those countries. On the other hand, the U.S. has very little ability to influence Chinese and Indian willingness to adopt GHG limits.

⁷ P. Bernstein, W. D. Montgomery and S. Tuladhar, "Potential for Reducing Carbon Emissions from Non-Annex B Countries through Changes in Technology," *Energy Economics*, Vol. 28, Issues 5-6, November 2006, pp. 742-762.

⁸ J. Reilly et. al. "Multi-Gas Assessment of the Kyoto Protocol," *Nature* 401: 549-555 (1999)

⁹ D. Malakoff, *Science* 278, 2048 (1997)

¹⁰ T. M. L. Wigley, *Geophys. Res. Lett.* 25, 2285-2288 (1998)

¹¹ Zili Yang and Henry D. Jacoby "Necessary Conditions for Stabilization Agreements" This paper was presented at the International Conference on "International Environmental Agreements on Climate Change," held on May 6-7, 1997, in Venice, Italy p.5

The Kyoto Protocol provides insufficient incentives for new technology

Some have suggested that by putting a price on carbon emissions, the Kyoto Protocol would induce industry to develop the new technologies to drastically reduce GHG emissions. A price on GHG emissions would encourage further refinement and commercialization of new abatement technologies. Unfortunately, a price is a poor tool for encouraging the more basic R&D needed to effect very large reductions in GHG abatement costs. Edmonds and Stokes convey the essence:

For technologies that are “on the shelf” or technologies that are near commercialization, this argument is largely undisputed. But putting technologies on the shelf is another matter. That requires R&D and R&D suffers from the problem of inappropriability. That is, private actors cannot capture the full economic benefits of the R&D they conduct and therefore there is a systematic underinvestment in that activity. Moreover, the more basic the R&D, the harder its fruits are to appropriate. The difficulty then lies in getting the technologies to the point where they can be put on the shelf. At the very least, there is a problem in laying down the foundations upon which new technologies can be built. All of this speaks to the problem of the public-private interface in the creation of a climate policy. There is a clear need for R&D that goes beyond that which even the best market economies would foster in the private sector.

Montgomery and Smith point out that even if the appropriability problem were solved, it is impossible for governments to make a credible commitment to future carbon prices high enough to motivate private sector R&D. The only substitute is a set of public policies to provide additional direct incentives and funding for R&D, policies that are completely missing from the Kyoto Protocol.

International cooperation on R&D has at least three advantages over uncoordinated national approaches.

1. If every country knows its efforts will be matched by others and the accomplishments of R&D are shared, each country will gain greater benefits for every dollar it agrees to spend. Thus internationally coordinated research should be able to achieve far greater total funding than the sum of funding that countries would be willing to undertake on their own.
2. Cooperative R&D and international exchanges of students and researchers can create additional capabilities worldwide by providing advanced training for scientists and engineers from developing countries that do not have their own world-class research establishments.
3. R&D in which developing countries are actively involved can better identify innovations and technology most appropriate to the resources, markets and skill levels in those countries, and thus more rapidly and effectively develop

technologies that will bring down the cost of reducing emissions in developing countries.

Barrett's findings about the instability of an agreement based on targets and timetables do not apply to agreements dealing with cooperative R&D. He finds that an agreement on R&D is both feasible to negotiate and capable to address the critical problems in practice: "it does not require that compliance be enforced, and it provides positive incentives for participation."¹²

The Kyoto Protocol is not motivating engagement or effective action on the part of developing countries

It is not the lack of U.S. participation that makes the Kyoto Protocol fall short of achieving sufficient reductions in emissions to achieve climate goals. The reason for the ineffectiveness of the Kyoto Protocol – and this would still be the case if the U.S. were to undertake unilaterally a standard equal to Kyoto or tighter -- is that developing countries are not only outside of the agreement but are benefiting from the competitive distortions that it creates.

Developing countries have shown no interest in adopting emission limits and becoming part of the global system envisioned under the Kyoto Protocol. These countries consistently give higher priority to economic growth and its ability to ameliorate much more pressing social problems. Their point of view, and its implications, are well described by David Victor and Danny Cullenward of Stanford University:

The rub, though, is that developing countries have refused to accept limits on their emissions. Their interests are different from the industrialized world—they seek development and are wary of any scheme that would impose immediate economic costs for the more distant benefit of reduced climate change

Luring developing countries into an emissions trading system would require printing large number of extra permits—headroom to grow. Such a strategy, while well-intentioned, would actually undercut serious efforts to control emissions elsewhere in the world by flooding emission permit systems with extra permits. Exactly such a deal was struck to get Russia and Ukraine to join the Kyoto Protocol; both countries refused to join Kyoto unless they were given generous headroom that was akin to printing a huge windfall of free extra permits.

The target and timetable approach in the Kyoto Protocol, even if coupled with international emission trading, forces developing countries to trade off emission reductions and economic growth. As a result, there are only two paths forward: industrial countries act alone, suffering competitive disadvantages and strengthening the incentives for countries like China and India to remain outside the agreement, or the

¹² Scott Barrett, "Towards a Better Climate Treaty" (July 2002). FEEM Working Paper No. 54.2002. Available at SSRN: <http://ssrn.com/abstract=318681> or DOI: 10.2139/ssrn.318681

industrial countries make immense cash payments to those countries, over and above current trade deficits, to induce them to participate.

Given developing countries' perceptions of the conflict between economic growth and emission reductions, it is naïve in the extreme to believe that adopting mandatory limits will automatically cause developing countries to follow our lead. Instead, limits on emissions from industrial countries will cause a shift in investment toward those developing countries, so that our emission reductions will be offset by greater increases in emissions outside the United States.

Finally, and this point is widely misunderstood, the competitive advantage that China and India would gain from unilateral emission limits in the United States makes those countries even less likely to agree to future limits on emissions. Moreover, once China and India build industries that depend on a difference in energy cost to succeed, it will become politically even more difficult for those governments – and others in the same position -- to undertake policies that threaten those activities.¹³ Thus far from providing a moral example that will bring countries like China into an international agreement, naïve unilateral action will create economic disincentives for those countries to limit their emissions. Thus, if the U.S. were to ratify the Kyoto Protocol, it would simply further deepen the incentives for China and India to stay out of the agreement.

There have been, as Victor and Cullenward mention, proposals to provide China and other developing countries with sufficiently generous allocations of allowances to provide both headroom for growth and sufficient extra permits that the sale of those permits could compensate them for any perceived losses. As they mention, the precedent for this is the “hot air” given to Russia to induce it to agree to the Kyoto Protocol. This approach would entail wealth transfers from the United States and other industrial countries far larger than current aid budgets. Moreover, these payments would go almost exclusively to two countries, China and India, whose rapid economic growth makes them unlikely candidates for our aid.

For example, the International Energy Agency predicts that by 2020 China's emissions will be about 6 billion tonnes (CO2 equivalent). At a carbon price of \$50 per tonne, an allocation sufficient to cover China's projected 2020 emissions (to give “headroom” for growth) would be worth \$300 billion dollars per year. Should China find ways to prevent growth in emissions through 2020 by exploiting what appear to be cost-effective changes in technology and energy efficiency, it would be able to sell about 1.5 billion of those allowances per year, adding \$75 billion per year to its trade surplus, all at the expense of industrial countries who would be providing the overallocation of allowances.

Recent research suggests that China and India with their massive coastal plains may be the countries that would suffer the largest share of world damages from climate change.¹⁴ These countries should therefore be motivated to participate in an international agreement

¹³ H. D. Jacoby, R. Prinn et al. Kyoto's Unfinished Business, *Foreign Affairs* Vol 7, No. 4.

¹⁴ David Anthoff and Richard S.J. Tol, On International Equity Weights And National Decision Making On Climate Change, February 13, 2007 Working Paper FNU-127, Free University of Amsterdam.

to reduce greenhouse gas emissions for their own national interest, and not need any additional inducements. They are also far from being the poor countries to whom we want to send our aid. By offering—even implicitly—to pay these countries to join a global trading system in which their current and expected emission rates would be grandfathered, we give them an incentive to eschew actions that would be in their unilateral interest if we took a more hardheaded approach.

The remedies for the unwillingness of developing countries to undertake significant emission reductions are not easy to find, but it is clear they are not being provided by the Kyoto Protocol or its Clean Development Mechanism. China and India are claiming most of the money going into the CDM, as I discussed earlier by building factories that produce exotic greenhouse gases and then earning CDM credits for destroying those same gases. All of the major developing countries have expressed their opposition to any form of mandatory cap on their carbon dioxide emissions, because of valid concerns that in their current state of institutional development such caps would interfere with their industrial growth.

An alternative approaches to an international agreement can reconcile growth with declining emissions

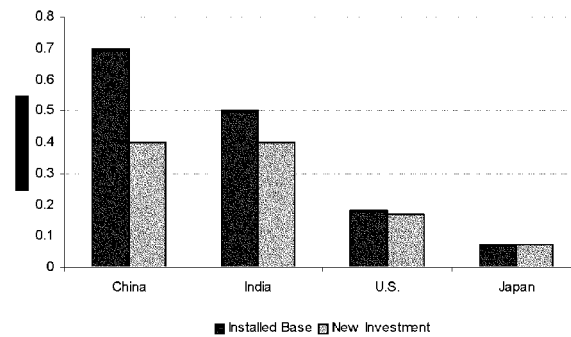
There is in fact an immense potential for cost-effective emission reductions in developing countries, but that potential can only be unlocked if those countries adopt the deep institutional reforms that are necessary for the efficient functioning of markets and sustained economic growth.

There are in fact immense opportunities for reducing emission in these countries in ways that would improve their prospects for economic growth – if the governments of China and India could muster the political strength and will to end market distorting policies even though these policies may have the support of important constituencies. If they are able to meet this challenge, a dollar spent in developing countries could be expected to create much larger emission reductions than the same dollar spent in the United States or any industrial country.

These opportunities exist because of the outmoded technology used in China and other developing countries, and the lack of market institutions to create effective incentives for efficient energy use. The technology of energy use in developing countries embodies far higher emissions per dollar of output than does technology used in the United States; this is true of new investment in countries like China and India as well as their installed base (See figure below). The technology embodied in the installed base of capital equipment in China produces emissions at about 4 times the rate of technology in use in the United States. China's emissions intensity is improving rapidly, but even so its new investment embodies technology with twice the emissions intensity of new investment in the United States. India is making almost no improvement in its emissions intensity, with the installed base and new investment having very similar emissions intensity. India's new investment also embodies technology with twice the emissions intensity of new investment in the United States.

Thus large emission reductions can be achieved in developing countries through introduction of technologies that are now the standard in industrial countries, and at the same time improve their productivity and prospects for economic growth. The situation is exactly the opposite in the United States, where our generally efficient markets and advanced technology means that we must incur substantial additional costs to reduce emissions. The United States is a good benchmark of technology that is economic at today's energy prices, without any additional incentives or regulations that would lead to adoption of more costly technologies for the purpose of reducing greenhouse gas emissions.

Greenhouse Gas Emissions Associated with Existing and New Investment
(Million tons C per \$Billion GDP)



Source: Bernstein, Montgomery, and Tuladhar

Priorities for Economic Growth

Developing countries have made it clear that their highest priorities are dealing with poverty, disease, famine, unemployment and violent conflict, and that sustained economic growth is a prerequisite for dealing with these problems. Therefore, nearly all developing countries have refused to accept caps on their greenhouse emissions and have expressed no interest in becoming part of a global emission trading system—at least on terms acceptable to the industrial countries. China's commitment to what might be described as growth at any price is clear. These countries see the targets and timetables approach to climate change policy as threatening their ability to grow and deal with their more pressing problems. Therefore, only approaches to climate policy that combine greater economic growth with reductions in emissions intensity have any chance of attracting the interest of developing countries.

The Importance of Technology Transfer

Technologies that offer lower CO₂ intensity have largely been developed in the industrial countries. Therefore technology transfer, which occurs largely through foreign direct investment, is required to replace carbon-intensive technology.

Technology transfer and increased investment have the potential for achieving large reductions in emissions. The potential from bringing the emissions intensity of developing countries up to that currently associated with new investment in the United States is comparable to what could be achieved by the Kyoto Protocol.¹⁵ These are near term opportunities, from changing the nature of current investment and accelerating replacement of the existing capital stock. Moreover, if achieved through transfer of economic technologies it is likely that these emission reductions will be accompanied by economic benefits for the countries involved.

Causes of High Carbon Intensity and Effective Remedies

In a highly developed economy such as the United States, characterized by efficient markets, pricing relatively undistorted by government policies or government-owned enterprises, free trade and free flows of capital, and strong legal institutions and protection of property rights, it is likely that there are few opportunities to improve carbon intensity without causing reductions in economic performance and income per capita. If technologies offering such opportunities exist, market forces and individual economic interest will lead to their adoption. This is not the case in many developing countries, which have economic systems characterized by a lack of incentives for efficient energy use, due to institutional and market failures, and an investment climate that discourages foreign investment and technology transfer. Remedying these institutional and market failures offers the prospect of reconciling economic growth and emissions reduction.

The modern literature on economic development emphasizes the role of legal, market and governmental institutions in economic development. The concept of “economic freedom” summarizes a wide variety of conditions that are found to be conducive to individual initiative and economic growth.¹⁶ Indices of economic freedom are based on comprehensive surveys of conditions around the world. The broad indices of economic freedom include specific institutional problems that can lead to high carbon intensity:

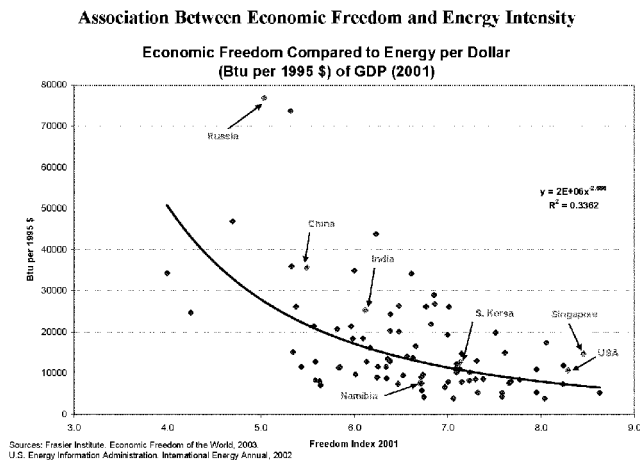
- Pricing systems that make efficient technologies unprofitable
- Institutions and policies that make markets inhospitable to foreign investment with world class technology

¹⁵ These calculations are provided in Bernstein, Montgomery and Tuladhar

¹⁶ *Economic Freedom of the World (EFW)* index is published by The Frasier Institute (<http://www.freetheworld.com/release.html>) and measures the degree to which a country is supportive of economic freedom. The EFW summary index is constructed from five different policy areas: (i) size of government; (ii) legal structure and protection of property rights; (iii) access to sound money; (iv) international exchange; and (v) regulation. *Index of Economic Freedom* is published by the Heritage Foundation/Wall Street Journal (<http://www.heritage.org/research/features/index/>) and reports 10 broad measures of economic freedom for 161 countries.

- Rule of law and protection of intellectual property
 - Role of state owned enterprises
 - Access to foreign capital
- Lack of required infrastructure, education and skills to utilize technology

Lack of these components of economic freedom is clearly associated with high levels of energy use per dollar of GDP. The figure below plots scores on the Economic Freedom of the World Index compiled by the Frasier Institute against energy use per dollar of GDP, measured at market exchange rates.



Energy intensity is used as a measure because it is directly connected to greenhouse gas emissions from energy use. For example, three of the countries with the relatively poor scores on economic freedom, Russia, China and India, have high energy use and carbon emissions per dollar of GDP. At the other end of the scale, countries like South Korea, Singapore and Namibia with relatively free economies have much lower carbon intensities, similar to that of the United States.

The curved line represents the results of a statistical analysis of the association, which shows that about one-third of the variation in energy intensity is explained by differences in scores on economic freedom. This is an unusually clear relationship for this type of cross-sectional data. The literature on economic development also shows that the economic freedom index is very closely associated with per capita income and rates of economic growth.

In more recent work I have focused on specific aspects of the institutional setting that can be expected to have a direct effect on either the efficiency of energy use or the transfer of economic technologies.¹⁷ This research reveals that both China and India have significant institutional shortcomings in such areas as the rule of law and administration of justice, protection of intellectual property, excessive bureaucracy and corruption, a dominant role of state enterprises in the economy, and inadequate infrastructure. In both countries, continued economic reform is recognized as being necessary to sustain current rates of economic growth. We have also found that the same institutional problems are directly connected to wasteful energy use, by diminishing or eliminating incentives for efficient use of resources, and discourage foreign direct investment of the type that leads to effective technology transfer.

Design of Policies that Can Be Effective and Engage Developing Countries

The evidence that high emissions intensity is closely associated with fundamental market and institutional failures leads me to conclude that the highest priority in international negotiations should be to facilitate the process of removing market and institutional failures in China and India.

Without remedies for the fundamental institutional problems that underlie poor scores for economic freedom, the continuation of two unfortunate current conditions can be expected:

- A hostile economic environment in China and India will prevent technology that is introduced through projects that the Partnership might support from spreading throughout the economy
- Emission caps will remain costly, because without new technology, emission reductions will require diverting resources that could otherwise be used for growth

If remedies are found for fundamental institutional problems, two kinds of results can be expected:

- Projects that transfer economic technologies will take place without further incentives and will lead to spillover effects and significant emission reductions
- The root causes of both poverty and high carbon intensity will be addressed together

¹⁷ W. D. Montgomery and S. D. Tuladhar, "The Asia Pacific Partnership: Its Role in Promoting a Positive Climate for Investment, Economic Growth and Greenhouse Gas Reductions." International Council for Capital Formation, June 2006.

The actions required to create fundamental institutional reform must take place within the developing countries themselves, and be designed and carried out by their governments, businesses and citizens. What is needed is a process in which all these countries can work together to identify the needs for institutional reform in China and India, understand the benefits that institutional reform would provide in enhancing economic growth and reducing greenhouse gas emissions, and take on appropriate responsibilities for bringing about those changes. But to do this, engagement with these countries must make institutional reform the highest priority.

Finding approaches to engaging these developing countries is critical to managing climate risks, and these approaches must directly address technology transfer and institutional reform. Although the Kyoto Protocol offers little hope of doing so, these can be addressed in future negotiations involving a more limited number of parties under a different architecture than the target, timetables and emission caps that the developing countries find unacceptable. I now turn to how these negotiations might be structured

Engagement in a global process

The Committee on Foreign Affairs has a particular interest in the principles that might guide the U.S. in international negotiations to develop a framework for managing the risks of climate change. The climate problem will not be solved by U.S. ratification of the Kyoto Protocol, for the reasons I have discussed already. Designing an effective international architecture is in fact very difficult, and the greatest U.S. contribution would be to convince the rest of the world to recognize and confront those difficulties in a realistic manner. Effective action on climate risks requires that the U.S. challenge those who would be satisfied with cosmetic changes or tinkering with the Kyoto Protocol, and instead insist on a new approach that can deal effectively with the critical challenges of enforceability, technology and developing countries.

The experience of the Kyoto Protocol, both in its formulation and in its execution, suggests five guiding principles for a realistic and effective architecture:

- Avoid creating unintended incentives that lead to perverse consequences of an agreement.

This has been one of the clear failings of the Kyoto Protocol. In broad, its architecture encourages developing countries to remain outside of the agreement as long as possible, and its short-term focus fails to provide incentives for either innovation or large capital investments. In detail, the design of the CDM has wasted resources on projects that garner credits for destroying high-GWP gases that would never have been produced in the first place without the perverse incentives of the CDM.

- Be clear about foreign policy objectives and focus benefits on those in need

There is no question that for both moral and foreign policy reasons, we should be concerned about alleviating poverty around the world. The rise of China is also a major

foreign policy concern. The CDM directs most of its funding toward China and other countries already embarked on rapid economic growth, and leaves the poorest out completely. A global emission trading regime would require massive wealth transfers to convince China to join, and again provide almost nothing to the poorest. Since China is likely to be one of the countries most affected by climate change, its gains from participating in a global effort to limit emissions are likely to exceed its costs. Although there are legitimate arguments that industrial countries should bear the cost of protecting the poorest, it is difficult to see why we have any moral obligation to pay China to participate. A focus on the connection between institutional change and economic growth would aid the poorest, and help to put them on a path toward sustained and environmentally sound economic growth.

- Concentrate on promoting the most important changes in the proper order

For the Annex B countries, the highest priority should be development of technologies that can make long term goals of stabilizing global temperatures economically feasible for all countries. The largest cost-effective opportunities for near-term emission reductions are in developing countries. To achieve these reductions, and to slow and ultimately reverse the growth in emission from developing countries, the focus must be on promoting institutional change to create efficient markets and a favorable investment climate. Timing of reductions in emissions from industrial countries needs to be paced by technology and developing country participation.

- Negotiate only incentive-compatible agreements

As the work of Barrett and others has shown, there is no incentive under the Kyoto Protocol for countries to join or to adhere to their agreements. This is an inherent problem of the targets and timetables approach to an agreement among sovereign states. To create an agreement in which parties have an incentive to live up to their commitments, some form of “pledge and review” is required. This involves a discussions of concrete actions that can be monitored effectively and entail credible consequences for failure. An example might be reform of electricity pricing in India in exchange for transfer of specific U.S. technologies on concessionary terms, with the credible threat that the technology transfer will cease if India fails to make specified changes on an agreed timetable. Discussions of internationally harmonized carbon taxes might also be compatible with a pledge and review approach, whereas emission trading requires targets and timetables.

- Limit negotiations to the nations that make a difference

One of the reasons that so little has come out of the Kyoto and UNFCCC negotiations is that they include nearly 200 parties, most with primary agendas completely unrelated to climate issues, in an unwieldy and inconclusive consensus process. Since 75% of global emissions come from just 13 countries,¹⁸ limiting future negotiations to the “big emitters”

¹⁸ In order, the U.S., China, EU25, Russia, India, Japan, Brazil, Canada, S. Korea, Mexico, Indonesia, Australia. Adding Ukraine, Iran, and S. Africa brings to total to 80% of global emissions.

would be much more likely to produce a workable agreement. Getting out from under the UN's processes is particularly important to allow the discussions to address different architectures for the post-2012 period, but even if the goal remains to agree on future targets and timetables, negotiations need to be confined to the big emitters. Regional and bilateral discussions, such as the Asia-Pacific Partnership and the U.S.-India Strategic Partnership, can supplement these negotiations and provide examples of how to achieve effective engagement with developing countries.

Mr. GREEN. Thank you and again thank our witnesses for being here and your expertise. I yield myself 5 minutes, and I just have a very long question, and I will try and go through it very quickly not only for Ms. Claussen but our three panelists. One of the reasons U.S. is in such a strong position to direct a climate change debate is because of our strong economy and our market. I am concerned about the U.S. adopting a cap-and-trade legislation unilaterally and putting the burden of solving this problem on our domestic manufacturers that produce energy intensive material such as steel, aluminum, cement and fertilizer.

If these companies are forced to follow a cap-and-trade while their international competitors are not, they will not be able to stay competitive. Can we expect a cap-and-trade program to raise energy prices if that happens in the United States and a reasonable estimate? Will U.S. firms and workers suffer a competitive disadvantage against energy intensive products sold in U.S. markets but manufactured abroad where there are no greenhouse gas control?

And if Congress is willing to regulate how much greenhouse gases are produced in manufacturing certain products sold in the U.S. regardless of origin, foreign or domestic, does Congress have the power to do that kind of environmental regulation given that our environmental greenhouse gasses where they are released affect the U.S. climate, whether it is the United States or China? And if Congress took this approach, would foreign and domestic manufacturers have to comply with these regulations even if no treaty exists between us in order to sell in our market?

My point is we do not have some leverage in these countries that want to sell in our market. It seems like we would if we are going to comply with the greenhouse gas issues I think we as a leader we need to be the leader but we also need to make sure that we bring the rest of the world along with us. Is there a comment on that particular question or any variation of that question?

Ms. CLAUSSEN. Maybe I can go first here. I think the key to a cap-and-trade—which we believe should be the cornerstone of U.S. policy for itself—is that we do it in a rational way and not expect to do more than we can do faster than we can do it. If you look at the Call to Action from the U.S. Climate Action Partnership, it does not start immediately. It gives us a little bit of breathing room. It moves in a steady pace downward. In the early stages most of the reductions here in the U.S. will come from energy efficiency, which is actually a win-win for most companies.

Now with respect to the energy intensive industries, let me just say that we work with 43 large companies, including many in energy intensive industries—cement, aluminum, and others—and it is their point of view that there are things that can be done even within those sectors if they are done on a global basis. So we have suggested that global sectoral agreements that deal, for example, with aluminum or cement, would actually be the best way to deal with competitiveness concerns. The aluminum industry, for example, is already starting discussions on a global basis on how to do that and how to set benchmarks for the industry as a whole. The same is true in the cement industry.

There are others that might follow suit like steel, but that is perhaps the best way to deal with competitiveness concerns, because I think those are legitimate, not for everything in the U.S. economy, but for those energy intensive industries.

Mr. GREEN. Dr. Jhirad, a comment?

Mr. JHIRAD. Just to make a couple of points. One is that the industries who are working with us in the U.S. Climate Action Partnership are urging the Congress in this unusual way to pass strong legislation for two reasons. One is they feel that it creates a level playing field certainly across the country. Not a patchwork quilt of different state regulatory structures. So it is a common, coherent regulatory framework.

The second is that they feel that giving these policy signals encourages innovation in those companies. Innovation both in clean energy, energy efficiency and renewables. GE has pointed out that its Ecomagination initiative which they expected to net \$10 billion in 2010 reached that target two quarters ago. So they see this as a way to become more competitive as an incentive to producer higher quality technologies at lower cost.

I do think that there is a legitimate point to be made about competitiveness, and I think Ms. Claussen has made some of the points we feel are important but we are also looking hard at some of the tools that are available to us in the trade arena in addition to ones she has talked about, and you know we believe in saying things that we have analyzed, and so hopefully we will be able to provide an analysis of how these systems might affect competitiveness in the near future.

Mr. GREEN. Mr. Montgomery, but briefly if you please.

Mr. MONTGOMERY. Thank you. Yes. I think there is a cost to a cap-and-trade system and an impact on the U.S. economy. It depends on how tight the caps are and how high a carbon price would appear in the market with those caps. That is very hard to predict. That is one of the reasons why proposals for either a carbon tax which would be set by the Congress or a safety valve have been made. They can limit the damage, and they allow for a choice of how high a price to tolerate based in part on how much harm to competitive industries is tolerable or at what point that harm would begin to appear.

Can we do something about imports that would be competitive? I think that is an immensely complex issue of the GATT rules and the rules of the World Trade Organization. It is clearly something that is worth looking at. The rules suggest that there are immense differences in what kind of policy instrument that is used in the U.S. and how one treats it, and I think this is a subject that requires I think several more hearings to explore in any way. So I am not going to try to give a simple answer because there is none.

I think actually the real solution is global engagement because the issue here is the U.S. doing something which gets out too far ahead of what developing countries are willing to do to come along with us. Even WTO is a negotiation process rather than something that we can appeal to as a set of clear statutory law, and so I think all of that suggests that engagement with developing countries, bringing these competitive issues to the fore, and trying to concentrate on kind of how they can do similar things in industries

that are competitive with ours is probably the only real long-term solution.

Mr. GREEN. Thank you. The chair recognizes our ranking member.

Ms. ROS-LEHTINEN. Thank you so much, Mr. Chairman, and I wanted to follow up on similar themes that you had brought up, Mr. Chairman. A *Washington Post* article of April 9, entitled "Europe's Problems Color U.S. Plans to Curb Carbon Gasses," noted that a French cement company fears that as it meets emission cuts mandated by the Kyoto protocol it will steadily lose work to cement companies in Morocco. Those companies do not have to meet those commitments because Morocco is a developing country.

And as the article noted, this type of situation raises the question: How will companies that are forced to meet emission reductions and pay for the cost associated with that meet competition from similar industries in other countries that do not have to cut their emissions nor pay for a tax on those emissions? And this is an important question. One that is critical to U.S. policy in the future.

If we join in emissions control regime, how will we ensure that American companies and our workers are helped to stand up to competition from foreign produced goods made in countries that will not be required to greatly reduce their emissions and therefore will not have to pay the costs associated with that? And I will ask both questions if I could, Mr. Chairman, and then leave the time for our excellent panelists to answer.

Klaus Lackner of Columbia University believes that large scale carbon capture technology can be put into operation in the near term but the U.S. Energy Department's Assistant Secretary for Fossil Fuels recently stated that carbon sequestration technologies would not be ready for widespread deployment until the year 2045. What are your views on this debate over the near term availability and utilization of large scale carbon capture or sequestration technologies? Thank you, Mr. Chairman. I will listen to the answers.

Ms. CLAUSSEN. Maybe I can answer your second question first. I believe we are far closer to being able to implement carbon capture and sequestration than the Department of Energy does. I do think we need a large scale demonstration program that both deals with the capture issue and also with the sequestration issue in different geographies and different geologies.

We have suggested—and we are in the middle of some work on this—that you need about 10 demonstrations to really show that it is feasible, and about 30 if you really want to bring down the cost enough to make continued coal use cost competitive. Quite honestly, 50 percent of our electricity comes from coal. We have lots of coal. We are going to continue to use it. So I think the imperative is there for us to do this in a really significant way.

It seems to me that we should be ready to see wide scale implementation of this well before 2020, not 2045. One of the most urgent things that the Congress should do is to deal with coal carbon capture and sequestration. On your issue about cement, number one, you have to make sure that—

Ms. ROS-LEHTINEN. Well I did not mean it was on cement. It was about—

Ms. CLAUSSEN. On energy intensive industry.

Ms. ROS-LEHTINEN. Yes.

Ms. CLAUSSEN. You have to make sure that the largest, most significant emitting countries are part of any agreement. We think the number is 20 or 25. That is 85 percent of global greenhouse gas emissions. We also believe that for all of those energy intensive industries, we should pursue, as governments and as industry, sectoral agreements that deal with competitiveness issues. I think that is the best way to move forward. Thank you.

Mr. JHIRAD. Thank you. I will also answer the easier question first which is about carbon capture and sequestration. The most important scientific document in this came out very recently which was a report by the Massachusetts Institute of Technology, MIT, on the future of coal, and very clearly to do this on a very large scale means storing 1 billion tons of carbon dioxide every year. This is a scale that is a couple of orders of magnitude greater than what is done in oil and gas fields, and this does require some demonstration projects, as Ms. Claussen pointed out.

There are some science uncertainties, and there are some geological uncertainties, and we need to do this and we need to start very quickly to authorize some very large scale demonstrations to show that it can be captured on that scale. The second point is that the scientists who I spoke with are quite clear that there needs to be a carbon dioxide price or a carbon price for large scale carbon capture and storage to be viable, and the price they propose is something of the order of \$30 a ton of carbon dioxide.

So clearly this is an additional expense, but it is one of the most important things that our Congress can do is to begin to authorize an R&D program in large scale carbon capture and storage that we can do along with other countries such as India and China. That would be a good way to do this. We are in an international thermo-nuclear fusion research effort with many countries including India, China and Brazil, and something of this nature would qualify for that.

I also do feel that the consensus of people who have really looked at this issue, is that before 2020 is a feasible timeframe. I think 2045 is too long.

On the second point I do not have much to add until we have finished our analysis of the problem but I do think it is the subject of sectoral agreements, and we really need to look very hard at how these sectoral agreements might be structured from a trade point of view. This is quite complicated, and I do not have any simple answers for this.

Ms. ROS-LEHTINEN. Dr. Montgomery?

Mr. MONTGOMERY. Thank you. I can say even less about carbon capture and sequestration. I will just add the one point that I think both of my colleagues have left out which is it strikes me the real potential show stopper on carbon capture and storage are not technological issues. Those can be solved with sufficient research, as they have been describing. It is the legal, liability and regulatory framework that is adopted for carbon capture and storage that is really going to the issue.

Private firms are going to find it difficult to invest in storage of CO₂ underground if they are threatened with either having to shut

down their operations when EPA detects a tiny leak or with liability 100 years from now when the price of carbon might be astronomical. A realistic and regulatory liability regime needs to be developed and Congress may want to think about how to set some guidelines for that.

As to your first question, I really see no way of dealing with these issues of competitive harm and maintaining the viability of industries like cement in particular without making sure that the countries in which the competitors are located come along in the international negotiations at basically the same pace the U.S. is moving at, and that the U.S. limit how high a price we put on carbon to a level that is consistent with what those countries are doing to maintain competitive balance. Anything else I think is going to be a very difficult road to try to protect those industries.

Ms. ROS-LEHTINEN. Thank you to the panelists, and thank you to the chairman.

Mr. GREEN. Now I will turn to the gentleman from Massachusetts, Congressman Delahunt.

Mr. DELAHUNT. Yes. Thank you, Mr. Chairman. Mr. Montgomery, Dr. Montgomery, over here.

Mr. MONTGOMERY. Sorry.

Mr. DELAHUNT. Are you all in agreement that the issue of climate change is serious? Do you agree with I think the statement by Ms. Claussen that the science has concluded? That the issue of global warming, climate change has to be addressed?

Mr. MONTGOMERY. Yes. I think there are immense uncertainties about everything in the subject but it is clear that there are risks, and those risks need to be addressed and managed and reduced.

Mr. DELAHUNT. Thank you, Mr. Montgomery. I recently returned from Germany, and it was fascinating to me to note what the German Government and private industry have accomplished there in terms of renewable energies. We all hear of the transformation, if you will, of Brazil in terms of transportation fuels. I am concerned and tell me if my concern is valid, that the United States is slipping behind in terms of renewable technologies, and if we are, how do we address it, and how did this occur? Anyone on the panel.

Mr. MONTGOMERY. Could I start for this?

Mr. DELAHUNT. Sure.

Mr. MONTGOMERY. I do not think we are slipping behind on renewable technologies. I think we know quite well how to do what is the current state-of-the-art with renewable technologies, and that it is a matter of choice of what costs we are willing to pay in order to use renewable fuels because of their environmental benefits. For moving ahead, I think that the world is not moving fast enough on technology but the only way I can see doing something about it is putting our money where our concern is.

We need to appropriate substantially more money for R&D at the Federal level, and we need to think about ways of using our Federal resources to create incentives for the private sector to develop technologies and make the choices, and indeed I think it has to go all the way back to a very much more concerted effort to push for breakthrough R&D that can create totally new technologies that are going to be providing us ways of living without greenhouse gases.

Mr. DELAHUNT. I appreciate that answer. I find it reassuring because I really do think that Wall Street has woken up to the economic benefits to the nation in terms of renewable energies, and I concur with that. Anyone else?

Mr. JHIRAD. I would just say that what has happened in the last 6 months to a year has been absolutely phenomenal in terms of what Wall Street is doing in terms of factoring in climate risk. I think this is something we would never have predicted. I would agree that R&D budgets, not just in the United States but in the whole OECD, have been declining in real terms over the last 20 years. This reverse has to be changed.

And thirdly we need a better mechanism for cost and risk sharing with the private sector so that these technologies can get into the marketplace a lot more quickly. We need to accelerate that flow from the lab into the marketplace, and there are mechanisms, proven mechanisms for doing it which we need to adopt. So not just more money. It is also having qualitatively better ways of partnering with the private sector to speed this up.

Our venture capital industry is investing very heavily in innovations that are extraordinary but what I am concerned about is that if we do not have a clear policy environment we will be wonderful at bringing the innovations out but then the commercialization and capturing the market will go to other countries.

Mr. DELAHUNT. It will stall. One final question. You know in the Department of State obviously this committee has jurisdiction over the Department of State. Is there a lead? Is there a point person the bureau within the Department that is guiding our relationship in terms of climate change as it interacts in the international community, and if there is none ought there be one? Mrs. Claussen?

Ms. CLAUSSEN. I think actually it is rather diffuse in the current administration. There is someone who works solely on climate change. The Assistant Secretary of State for Oceans, Environment and Science, which is a position I once had, is not that involved in climate change. At the ministerial level, it is the Under Secretary for Global Affairs that does some work on this but there is no, in my opinion, real focal point for someone to really—

Mr. DELAHUNT. My point is if you all concur that there is a dire urgency to address this, ought there be a reconfiguration within the Department of State to represent the United States' position in terms not just of the Kyoto protocol, not just a multilateral agreement but in terms of promoting the United States and its efforts to market, if you will, our hope for innovative technologies that will come 2, 5, 10 years down the line.

Ms. CLAUSSEN. I think the answer is yes, and it probably should be some combination of global climate change and energy, because they are so closely linked.

Mr. DELAHUNT. Okay. Thank you.

Mr. GREEN. Congressman Rohrabacher.

Mr. ROHRABACHER. Thank you very much, and again let me just note you mentioned that the scientific principles are universally accepted, and that that just is not the case, and there are hundreds of scientists, prominent scientists from major universities around the world who disagree with that, and many of whom who have complained that they are actually being stifled, and that their ob-

jections are not being made part of the debate, as we see in every discussion where the decision has already been made, and thus dismissing arguments without having to take the intellectual honesty of going through the objections of very prominent people.

For example, Dr. Timothy Ball who is a climatology professor at University of Winnipeg, very respected man, I have a quote from him where he says:

“Believe it or not, global warming is not due to human contribution of carbon dioxide, CO₂. This in fact is the greatest deception in the history of science. We are wasting time, energy and trillions of dollars while creating unnecessary fear and consternation over an issue with no scientific justification.”

And again, the many, many scientists who object to this stampeding of the public on this issue point out that the earth has—we are not talking about whether or not the earth is getting a little warmer because the earth is getting a little warmer as it has in many, many cycles before it. In fact, the hearings that I have been through in the Science Committee indicate that since 1850 there has been a one and a half degree temperature rise in the earth’s temperature.

The trouble with it is the people that are presenting that to us did not mention that 1850 and that time period happened to be at the very tail end of a 500-year decline of world temperatures. So they took this time we should be so upset about that there is a degree and a half change. They took the temperature that they baseline at the end of a 500-year decline of earth’s temperatures. Not something that we should be concerned about.

It is also pointed out by some of these very same scientists that when Greenland was green and during that time period when the Vikings lived there with hundreds if not thousands of people in Greenland and Iceland that indeed that was a very wonderful time for the earth. That crops flourished when it was higher degrees of temperature back 1,000 years ago. Crops flourished. Populations expanded, and it was a time when civilization was greatly benefitted.

With that said, temperature rise in and of itself then is not a problem or not a problem we could deal with just as the temperature rise on mars and the other planets that we are going through right now is not a problem which is probably due to sunspots. Now with that said, let me note that that does not mean that those of us who challenge the scientific integrity of the arguments that you are presenting to us today have a disagreement with that we need to do things aimed at energy and cleaning the air.

I am totally committed to energy independence for this country for a number of reasons and which we all know. We are now vulnerable to foreign potentates and terrorist states which would do us harm. We are actually pumping money into the hands of people who hate our way of life. We do not need to do that. We should be developing energy resources, and those energy resources should be clean not because the air is any warmer or less warm than it was 200 years ago on the earth but because I have, like Mr. Lantos, I have three little kids that I want to have clean air and I want them to be healthy.

And I guess the question that I would like to throw out is: Is there not a parallel direction here that if we do not get focused on just certain, for example just COY, is there not a parallel course for those of us who are interested in human health that draws us together in a policy that may be parallel in terms of cleaning the air and creating energy independence, and that the global warming thing we may not necessarily have to be in agreement on that particular how you say motive behind those changes? Speechless, right?

Mr. GREEN. If you all could be as brief as possible.

Mr. JHIRAD. I will be very brief. Representative Rohrabacher, I clearly beg to disagree on the science but let us not have that debate here. But I looked at it carefully, and there are uncertainties in the impacts. There are uncertainties in the amount of warming but the thrust of the direction is pretty clear and compelling and real, and as a former astrophysicist, I would reassure you that sunspots are a tiny little perturbation on this problem. So just to put that on the side.

But the second point is yes, we should agree on a direction to take the country forward on clean energy. It is vital to creating new industries for the century we live in. Clearly our largest companies see that this is the direction of the future. It makes them more competitive in the international arena, and we can have clean air and clean water and live a lifestyle that encourages all of us to live better. So I hope that we will all agree on the clean energy dimension of all of this but I beg to disagree on the science.

Mr. ROHRABACHER. Thank you very much.

Mr. MONTGOMERY. I think there are two things that are two policy areas that pretty much any point of view on climate change would indicate are worthwhile. One of them is just a massive additional commitment to energy R&D, and especially to breakthrough R&D which is far enough back in the chain that you are not really sure whether it is going to help with energy independence or help with global climate. We just know that it is going to make a lot of energy technologies work a lot better.

The second thing I think really is an emphasis on institutional reform in developing countries. My research suggests that much of the reason for China's very dirty economic growth is its lack of the fundamental market institutions, the rule of law, the protection of intellectual property, the things that bring about technology transfer and efficient markets.

If we concentrate on bringing those changes about in the rest of the world, they are going to be good for economic growth. It does not matter how high a priority we put on climate change to make those things important in those countries.

Mr. GREEN. Congressman Payne.

Mr. PAYNE. Thank you very much. I am sorry that I missed your testimony but I just wonder—this is a simplistic question—if the current trends continue—I know Mr. Rohrabacher feels that perhaps it is not as bad as scientists say it is—however, could you—any of you or each of you—give me some examples of the worst case scenarios?

What would happen to the polar caps? What would happen to coral reefs? What would happen to maybe islands out in the Pa-

cific? What happens to our coastlands on the east coast of say of the U.S. or even the west coast? Could someone just try to give me really a worst case scenario? Because I am one that does believe that this thing is a little more serious than some of our colleagues feel it is.

Ms. CLAUSSEN. If I could, let me just run down a list of some of the possibilities. Even if the polar caps do not melt entirely, we are talking about substantial sea level rise, which will affect parts of the United States, particularly around the Gulf, but also up and down the coasts, more in the southern part than in the northern part. That is a global issue because there are many low lying countries, and that in itself could cause migration and other national security issues.

We believe there will be both more droughts in some areas and more storms in others, both of which are very costly to deal with and potentially devastating. We think there could be human health concerns from increases in the temperature. There is no question that there will be loss of biodiversity. Some species can move north to accommodate. Some can accommodate where they are. Others will not be able to. So we will likely see loss of biodiversity as well. So we believe this is a really serious problem and one of the reasons why we need to act, and we need to act with some urgency.

Mr. JHIRAD. Just to support what Ms. Claussen has said and which has also been put out by the intergovernmental panel on climate change in their second report in April where they looked at the effects of various amounts of climate change on all of the countries of the world, and certainly the report of the generals and admirals drew very heavily on that in terms of their worst case scenarios, in terms of massive drought, sea level rise, increased frequency of foreign five category hurricanes or the equivalent with typhoons.

That this was very much in the cards and this is not even talking about the absolute worst case which is complete melting of the polar ice caps and the stopping of the Gulf Stream and all of those extreme cases. The Pentagon has commissioned some analysis on this because there is beginning to be a realization among our military community that this represents the mother of all security problems, and that we are not equipped to deal with the refugees in the hundreds of millions whether in Africa or in Asia or anything like that. So this has now become top of the agenda for our military planning.

By the way, I do not want to sound as though I am a doomsday advocate or a scare monger here because I do want to make that clear. I do not want make that impression. But we did spend 50 years in the Cold War looking at potentially catastrophic events that at the time we thought had low probability. The probability varied from time-to-time. During the Berlin air lift, it got higher. The point is that we spent a lot of money, probably in today's terms, trillions of dollars in dealing with phenomena that could have had potentially worst case or catastrophic consequences but where the probabilities were small.

So I do not want to draw the analogy too closely but as a group of policy folks we feel that we need to think long term and to start

acting immediately to ward off the worst case or even the bad cases that we have heard.

Mr. MONTGOMERY. I think I just want to add—I think Dr. Jhirad is saying this—there is an immense amount of uncertainty about all of this. There is a small chance that all of this is going to go away and nothing bad is going to happen. There is a small chance of catastrophic consequences in our lifetime. I think most of the scientific opinion is it is most likely something in between is going to happen. That is why I think about it as risk management rather than a very specific worst case that we know we can avoid.

Mr. PAYNE. Thank you very much.

Mr. GREEN. Thank you. Congressman Bilirakis.

Mr. BILIRAKIS. I think it is working, yes. Thank you, Mr. Chairman. This is for the whole panel. Yesterday the *New York Times* reported that the CIA Director McConnell agrees that the CIA ought to be in the business of producing a national intelligence estimate on the effects of global warming on our national security. Last week, as you know, the House passed the Intelligence Authorization bill which included the funding for intelligence agencies to conduct a global warming impact study.

My question is: Do you believe that our intelligence agencies are equipped to conduct such studies, and do you believe that global warming is a more imminent threat than terrorism?

Ms. CLAUSSEN. Let me take a quick try at that. Do I think our intelligence agencies are equipped? If they are not—and I probably have some questions about whether they are at the moment—I think it is very important that they become equipped because it is an issue that they need to be able to deal with, and that could be done. You asked about whether it is a greater threat than terrorism. I think there are many threats, and we just have to learn how to deal with them all.

Mr. JHIRAD. I certainly agree that—and this is happening already—that the Pentagon and our intelligence communities have to become very serious about this issue. I think that there has been a clarion call from top leaders that this could be a set of security issues that confronts us around the world that we are not prepared to deal with in conventional terms, and that I hope that they will acquire the capacity to deal with these issues in a comprehensive way and which really represents a new attitude toward forward engagement.

We thought about forward engagement as a military strategy. Now we should think about forward engagement in terms of unanticipated and perhaps dire consequences. So yes. And again, we have many threats. I would hate to have a comparative analysis of which is worse. I certainly would not want to go there but I certainly want to say that we need to acquire the capacity to deal with this set of threats. They are interconnected. They are on many different time scales. There in many different nations, and I think this is a whole new set of threats that we need to have a kind of forward engagement capacity to deal with in our intelligence community.

Mr. MONTGOMERY. I think there is something we finally disagree on. This is a topic that actually was part of what I did when I was with the U.S. Government. I chaired an interagency group dealing

with the analysis of energy security issues and oil supply disruptions, worked fairly closely with the intelligence community in doing that, and I would say first, I am somewhat attracted to the notion of a national intelligence estimate looking at the effects of global warming and national security because there has been so much utter nonsense said about the subject that I think it might be a good idea to have a dispassionate and objective view taken, and I think the CIA and the intelligence community are capable of that kind of independence.

Having said that, I think it is absurd to say that global warming can pose anywhere near as clear and present a danger to the United States as terrorism. We are simply talking about different time scales. And I am concerned given that it is not just a matter of money in the intelligence community. I have immense respect for the people I worked with there who dealt with international energy issues. They really knew their business but there were very few of them, and they were heavily tasked with many things, and it takes a long time to develop people in an agency, and I do not know whether it would be a good idea to have people there with their limited capability of a number of hours in a day divert their attention to this.

It is not a matter of whether we should be putting lots of money into intelligence. We should but I am not sure we have enough people there right now with the expertise to do this that it would be a good idea to divert them from I think are in fact any reasonable time scale more pressing dangers.

Mr. BILIRAKIS. Thank you. I have one more question, Mr. Chairman. Do we have time? I can ask them afterwards.

Mr. GREEN. You have 30 seconds.

Mr. BILIRAKIS. 30 seconds? Okay. I will ask you afterwards. Thank you.

Mr. GREEN. Both those of us from Texas and Florida have a hard time getting a question in 30 seconds. Congresswoman Sanchez.

Ms. SANCHEZ. Thank you, Mr. Chairman. This question is for all of the panelists. There are actually two. I will ask them, and then if you could please respond. The Bush administration's failure to rejoin participation in Kyoto protocol and its rejection of mandatory self-imposed limitations of greenhouse gas emissions has created quite a dilemma when it asked developing countries to implement rigorous efforts to reduce greenhouse gases.

The two questions that I have are: First, are there any alternatives to rejoining the Kyoto protocol that will pacify what I think is correct international criticism? And the second question is: Would a serious United States commitment to climate change improvements persuade other developing countries who have not ratified the Kyoto protocol to engage in these discussions?

Ms. CLAUSSEN. If I may begin. I think the issue is no longer joining the Kyoto protocol, because the budget period ends in 2012. Most of the world is looking at what succeeds Kyoto and what kind of an agreement we can forge for the period after 2012. The most important thing for the United States is to be very active in trying to work through a framework that goes beyond 2012 and actually has a chance of solving the problem.

There are two things the U.S. really needs to do. The first is to take some action to deal with our own emissions, because that is the only way we will have the credibility to (1) be a leader abroad, and (2) to persuade the major developing countries. They have to be a part of anything that comes next to do something to limit their own emissions.

Mr. JHIRAD. Very quickly. I think that the message that resonates with industry leaders in India and China is the fact that mandatory policies to cut carbon can be a spur for technological innovation that will make their industries more competitive, not less competitive, and can provide what are so-called co-benefits can also help local air pollution and local water pollution. The President of India called recently for meeting 25 percent of India's power requirements in 2030 with renewables. This is equal to 100,000 megawatts of power.

In order to get there, it is clear that many of the industry leaders are promoting policies that will begin to encourage a path that will give carbon a value, and so this coalition that we have seen in the United States of large industries and nongovernment policy research groups is getting some traction abroad because as they see that this coalition can actively act to promote policies that will lead to technological innovation.

I think that when one talks about technology and investment you really get heard in India and China, and if this is seen as a way to accelerate economic growth—especially for the poorest—while at the same time cutting emissions, I think that is the way to go, and that is the dialogue but we will not be credible in that conversation unless we have done it ourselves, and that is the problem we have is that we find ourselves either demonizing these countries, like India and China, or lecturing them but we do not say well we have done it, and it works, and we would like to be in a position to say that.

Mr. MONTGOMERY. I think that—

Ms. SANCHEZ. Excellent point.

Mr. MONTGOMERY [continuing]. We all actually agree that the United States needs to re-engage in developing an alternative framework for long-term action internationally. We may not exactly agree what that framework should include but we all think there needs to be a new one. As far as developing countries go, we hear frequently the developing countries saying you go first. I have never heard them say we will follow, and saying you go first is not the same as saying I will follow.

As I have indicated in my prepared testimony, I think that moving too far ahead creates competitive disadvantages for those countries to stay outside the agreement and continuing to concentrate on energy intensive industries, and we do not want to create too much of that incentive. I think engaging them on technology transfer, which is something they really want, is the area that we can begin to make some progress, and I think maybe we have some consensus on that.

Ms. SANCHEZ. Follow-up question for you, Dr. Montgomery. But do we not lose credibility if we say, you must do this but we are not doing it? I mean I can understand the “you go first and I will follow,” but it is sort of almost patronizing to say, “You must do

this, although I am exempt because do I say not as I do." Does that not lose U.S. credibility around the world?

Mr. MONTGOMERY. I think the U.S. needs to be very clear in articulating what we are doing and why. If the U.S. adopts a set of emission caps, by passing any of the legislation that we are seeing in the current Congress, that is certainly something the U.S. could point to. If instead the U.S. were to focus on a massive R&D program, that is something we could point to. I think we have probably not made clear enough in our discussions with developing countries that there are in fact immense opportunities for clean development in those countries that would probably be good for their economies, and that if we worked with them on those reasons and that is where we need to focus.

You are absolutely right saying that we think China should give up 10 percent of its GDP in order to reduce its emissions, and we are not willing to give up 1 percent of GDP to reduce ours, that is not going to convince anybody. If we say, we are taking actions here that we think are going to be effective in the long run, and we want to work with you on doing things that will not only reduce your emissions but be good for your economy, that is a different kind of engagement.

I agree with you. The United States cannot get developing countries into something like the Kyoto protocol because we would be asking them to undertake big sacrifices without making similar sacrifices. If we can develop that alternative framework that looks for win-win solutions, then that is not the choice anymore.

Ms. SANCHEZ. Thank you. I yield back.

Mr. GREEN. Congressman Smith.

Mr. SMITH OF NEW JERSEY. Thank you very much, Mr. Chairman. Mr. Chairman, just let me say for the record that I have long been concerned about global warming, and as early as 1989 sponsored an amendment to the Foreign Relations Authorization Act for 1990 and 1991 that was adopted that would have required the Secretary of State to study the feasibility of establishing a global warming prevention information network.

This network would have been tasked with disseminating prompt, accurate and comprehensive information concerning matters pertaining to global warming to foreign governments, business organizations, the public, and private institutions, and citizens of other countries. The amendment like I said was approved. Unfortunately the bill itself was vetoed.

In 1990, I also proposed legislation to establish an office of global change information that would disseminate information available in the U.S. that would be useful in identifying, preventing and mitigating or adapting the effects of global warming to various entities around the world. So when I look at section 103 of Chairman Lantos' bill, I am very encouraged that there are some real similarities, and I think you know this discussion draft which probably will be introduced soon takes us I think to a newer level, and I am looking at it very carefully, and I am glad the chairman has disseminated that to the members.

I do have two questions I would like to ask our very distinguished panel. Senator Sam Nunn testified last week and made the point, and I quote: "Energy demands will grow by 50 percent in the

next 20 years, even more in developing countries,” and he pointed out that as energy needs rise, as the pace of global warming increases, nations will look more and more to nuclear power.

And I am wondering if the panel could address the issue of how concerned you are that major incentives to go nuclear are perhaps unwittingly being unleashed as we attempt to address the very real and compelling danger of global warming? As we know, there are about 435 nuclear power plants in existence today. About a fourth of those are found in the United States. There are 28 globally under construction, and about 200 more that are planned.

Nuclear power has its own set of dire environmental dangers, not to mention the fear—and I am very, very concerned about this and I think everyone is—about dirty bombs as well as the proliferation issue of nuclear weapons. The more fissile material we have out there the more capability or the more potential there is for the making of bombs, and then there is that big terrible dismaying issue of nuclear waste, seemingly unresolvable.

As we know we are storing this very dangerous waste on site. We have two nuclear plants in the state of New Jersey. I have been to them. I look at these heavy casks filled with nuclear material, and I wonder what if you know somebody thinks that they could turn this into a dirty bomb? And then if Yucca Mountain ever does receive its anticipated waste, it would be filled within a couple of years, and then what do we do then going on into the future?

So nuclear waste is a serious, serious environmental risk as well as a risk to human life and to animal and all ecosystems. So I am wondering what your feeling is that we are perhaps incentivizing. We have to address global warming but we have to be so careful that we do not unwittingly unleash this second problem which would be an exponential increase in nuclear power.

Mr. JHIRAD. As you quite rightly said, this is being promoted as a carbon free option. The issues you described are very real, which is that one has to put in perspective if one were to triple the number of nuclear plants in the world to say more like about 1,500, this would be only about one-fifth or one-sixth of the increase in carbon emissions between now and 2050 so that even a tripling of the nuclear power capacity of the world is a very modest contribution to greenhouse gas emissions.

Having said that, perhaps the most authoritative look at the future of nuclear power which involves people on all sides of this question, which as the MIT report issued about 4 years ago pointed out exactly the issues you raised, which is that in order for this to be an option that is scaleable we will have to deal with proliferation. They recommended a once through fuel cycle so that you would not have plutonium coursing through the world, and that it would have to make economic sense.

At the moment at least in the U.S. context it is not going to work unless one has you know pretty giant subsidies for more plants, and the MIT group proposed a production tax credit so that they only get these subsidies if they actually produced a plant that produced kilowatt hours. But currently there are economic competitiveness issues. There are waste disposal issues. There are certainly proliferation issues.

We do not take a position on nuclear power at our institute but privately it should not be taken completely off the agenda when global warming is such an important problem but we should be cognizant of the risks. The political risks and the economics, and I would like to see those decisions be made in a way that meets both the safety concerns of citizens—I think public acceptance is going to be a big issue—and that make economic sense so that we are not subsidizing.

As I said a little while ago, you subsidizing nuclear plants is like subsidizing Donald Trump to build another tower. So we should not be subsidizing this technology. It is a mature technology. We have 435 nuclear plants operating, and we are going to have to manage them and manage the waste from them. So we should keep that option but we should approach it very, very cautiously.

Mr. SMITH OF NEW JERSEY. Yes.

Mr. MONTGOMERY. I have a somewhat different point of view. I think that just about every analysis that I look at of how we can achieve stabilization of global temperatures suggests or concludes that contributions have to come from a variety of sources. Nothing is going to provide 100 percent. But in fact, the contribution of nuclear power that Dr. Jhirad just described would be one of the largest wedges in contributing to stabilization of greenhouse gas emissions.

There are only a couple of energy sources that we can even think of that have zero carbon emissions and can be deployed on a scale that is not inherently limited. I can think of two of them, carbon capture and sequestration and nuclear power. If we take one of those off the table, nuclear power, I think that it makes it immensely more difficult and expensive to try to achieve any climate goals, and I would suggest that all the difficulties that you are discussing are ones that we have to face anyway, whether we have a growing nuclear industry or not.

The only solutions, in this case as many others, is to start finding ways to do the technology better. That may involve backing up and starting over again to find ways of doing some of the things that the MIT study recommended, making it again a problem that we need to put R&D money into, in order to get it right. But I think the tradeoff is one of an immensely more difficult task of meeting long-term stabilization goals without nuclear power.

Mr. GREEN. Thank you. Congressman Costa.

Mr. COSTA. Thank you very much, Mr. Chairman. A couple of questions, and I do not know if all three of you want to comment on it or not. Dr. Jhirad, you had mentioned in response to a question that was earlier asked to you, and to paraphrase you, that if we could ever get a comprehensive energy policy that that would be appropriate as we would follow through it. I am paraphrasing you of course.

But I think when you made that statement, you responded to a question that I continue to have and that is notwithstanding all the various efforts since 1973 when we had the first gas lines, there have been numerous efforts by every President I believe and Congresses to try to put together a comprehensive energy policy, and with a lot of fanfare, and of course we know we import more energy today, almost twice as much as we did in 1973.

What would the three of you define as the key components to what is real and what is not real, both in the interim and the long-term in advising Members of Congress what the impacts of global warming, what a comprehensive energy policy should in fact contain? Then my second question is: What any of you believe the merits of cap-and-trade are, and what we ought to be doing to implement a cap-and-trade policy?

Ms. CLAUSSEN. Maybe I can go first. I think the most important thing in an energy policy is that we have a diverse portfolio of supply options. A lot of our electricity comes from coal. It is cheap. It is available. From an energy security point of view, it is important. I think we just have to find ways to burn coal that does not harm the climate.

Nuclear provides about 20 percent of our electricity. I do not think we can deal with climate change successfully unless nuclear remains a part of that portfolio. Renewable energy at the moment is a very, very small portion of where our energy comes from. That can be vastly increased, and the state actions to deal with renewables—and I think there are 23 states that have renewable portfolio standards—that kind of thing on a national scale would make a huge difference and would be very beneficial.

But the most important thing is that now, unlike in the past, there are two really strong drivers for a comprehensive energy policy, energy security and climate change. There are many cases where they work together synergistically, and that has to be the way we move forward. It is a unique opportunity that we actually have not had before.

Mr. COSTA. I agree it is a unique opportunity but I think what is lacking is some consensus on what should be contained in that definitive list, taking a snapshot on what our current use is with some sort of logic as to over the next 5, 10 years what our future use will be, and where we are going to draw the existing—I mean we seem to be lacking that ability to do that.

Mr. JHIRAD. I agree with what was just said which was that we need both a policy for the electricity sector and a policy for oil and transport. Most of our security problems do not have to do with the electricity sector. They have to do with liquid fuels and oil. I think the electricity problems clearly we need to keep nuclear on the table if we are to reduce greenhouse gas emissions. We need to have carbon sequestration but I would say perhaps one of the most important things we have not done, because it is tough to do politically, is to price oil correctly.

Mr. COSTA. The Thomas Friedman concept.

Mr. JHIRAD. Yes.

Mr. COSTA. Put a tax on it and pay for everything that we need to do.

Mr. JHIRAD. And rather than subsidizing ethanol from corn and rather than subsidizing X, Y and Z, just give fossil fuel, you know add a dollar plus a gallon or whatever, and that will stimulate the market for a lot of technology. So instead of having special interest subsidies, we might consider just a blanket price.

Mr. COSTA. Bite the bullet and go for it.

Mr. JHIRAD. I am not an economist but my economist friends tell me that this is—

Mr. COSTA. You are obviously not a politician either.

Mr. JHIRAD. And I am not a politician either but I thought it might be refreshing to say the thing that is the third——

Mr. COSTA. No. I think it has merit. Quickly, Dr. Montgomery, because I am running out of time.

Mr. MONTGOMERY. I like what I am hearing. I think it is important to get the government role in R&D right, and I think for the rest of our problems we need to have direct performance oriented policies that attack the problems rather than try to create complicated government solutions for them, and putting a price on the things that we need to deal with is a really good way of doing that of it keeps it simple.

Mr. COSTA. Cap-and-trade quickly. My time is up.

Ms. CLAUSSEN. Cap-and-trade must be the cornerstone of the U.S. policy.

Mr. JHIRAD. I would endorse cap-and-trade heartily done right.

Mr. MONTGOMERY. There is more than one way to put a price on even CO2 emissions, and I think looking at cap-and-trade is one. A carbon tax is another. A safety valve is a compromise between the two. I think they all ought to be looked at because the cap-and-trade system may not be the best one.

Mr. COSTA. Thank you very much panel, and thank you, Mr. Chairman. My time has expired.

Mr. BILIRAKIS. Congressman McCaul.

Mr. MCCAUL. Thank you, Mr. Chairman. We can all agree that climate is changing. It is getting warmer. I think the real issue that we have to grasp and deal with as policymakers is what is causing that? We do know, at least the scientists I have talked to, that water vapor causes about 95 percent of the greenhouse gasses. So we are talking about the human element which is less than 5 percent.

We know that some of the ice caps, polar caps on other planets are starting to recede which is in our solar system where there is no human activity. So there seems to be a natural phenomena occurring, and then the question is: What do we do to deal with the warming change and the environment? It seems to me that the Kyoto treaty without China and India is not a very good option because those are the two and in addition the United States, two biggest offenders. They have 160 coal plants ready to fire up in China. How do we engage them is my first question?

The second one has to do with R&D investment. I think that you know the University of Texas in my district is dealing with the carbon capture and sequestration issue very well. It is a very exciting area in terms of energy policy. But again I do not think being punitive toward business and then therefore impacting our ability to globally compete is a good idea from the United States' standpoint.

What do we need to invest from the R&D technology standpoint that would best protect the environment, at the same time get us on an energy policy that is not dependent on foreign oil? And then finally the nuclear and solar, nuclear power and solar. You know Applied Materials in my district they are working intensely on solar energy. There is plenty of it, and it is going to last for a long time.

The nuclear option has been put on the table in this country for three decades, and it has gone nowhere, and yet it is essentially other than dealing with the waste that you get, it does not emit the carbons that we have to deal with. It seems to me France is 80 percent nuclear power. We ought to be looking at that issue as well. I will turn it over.

Ms. CLAUSSEN. I will try to be very brief. What can the U.S. do to engage the other big emitting countries? Two things: (1) do something nationally ourselves so that we actually have some credibility; and (2) find a flexible enough framework so that others will find reason to move forward. Incentives for clean energy are the way to proceed, because a lot of those countries are going to have huge demand for energy. We have to find ways for them to limit their emissions as they continue to grow.

You talked about coal and carbon sequestration. I agree. A lot of our electricity comes from coal. Eighty percent of China's comes from coal. If we are going to deal with global warming, we have to be able to deal with the burning of coal. I too am very encouraged by the possibilities for carbon capture and sequestration. We have more work to do to demonstrate that the technology works, and then we probably need a policy to make sure that people do it.

Nuclear and solar. Everything has got to be a part of the energy portfolio. Nuclear has to be. There is a lot of promise in solar, just as there is with wind, and in your state there is actually a huge amount of wind which has been very beneficial from an economic point of view as well.

Mr. JHIRAD. Again, to be brief, I think we need to greatly expand our R&D capacity to help portfolio technologies as there is no single magic solution here. I think that we also need to invest in how we can take our innovations and bring them into the marketplace more successfully. We are often very good at innovating and then finding that other countries will get the market benefit. I think this can change. There are ways to do this.

Very specifically I think that clearly we need to have advanced coal combustion solutions with carbon capture and storage. That is an absolute essential part of our R&D. That is an area we can collaborate with the Indians and Chinas of this world. I do think that there are potentially very interesting breakthroughs in thin film technology on the solar side that have the potential for cost reductions.

We are seeing advances in battery technology with much higher battery storage, much higher capacity to store electricity, which would be essential in bringing not just for transport for automobiles but also bringing more renewables and wind into the power grid. We need to advance to have a more intelligent grid, the so-called smart grid, where we can operate more like an energy internet rather than a one-way flow. I think that uses our strengths and information technology and in networks and in materials technology.

So there is a lot of work to be done in moving our grid into the 21st century and being able to accommodate a vast variety of wind and renewable energies and solar but I think that it would be nice to see that our R&D also works for the private sector to share costs and risks so that there is not a long lead time between the R&D

effort and bringing this into the commercial arena. So it is a diverse portfolio, and it is an opportunity to unleash a lot of American innovation and capture I think a much cleaner energy system and a much more efficient power grid.

Mr. MONTGOMERY. Thank you. I would say get the private sector involved. In the R&D end, we do need a much larger commitment by the Federal Government to R&D. I would say that the focus of that should be in the R&D end and on developing the breakthrough technologies. Do not waste the money on huge demonstration projects of current technology that are not going to take us into the future.

Leave it to the private sector to take that up when the technology is ready, and the same thing on developing countries, I think the engagement has to involve the private sector very heavily because what China and India need in order to improve their carbon intensity is technology transfer which usually comes about through foreign direct investment, which means that the engagement has to be doing things to improve their investment climate and make their markets work efficiency in order to get the private sector to do what it does well, which is use energy and all resources efficiently and bring the new technologies in that can bring their carbon intensity down to ours I think very rapidly.

Mr. MCCAUL. I thank the witnesses. Thank you, Mr. Chairman.

Mr. GREEN. Congresswoman Jackson Lee.

Ms. JACKSON LEE. Mr. Chairman, thank you very much, and thank you for hosting this hearing. The members are in a number of hearings, and this sort of had a red light on my calendar, and I wanted to make sure that I had the opportunity to be here. I want to take a moment just to sort of peruse where we are and the partners that have to be engaged in this process of global climate change and also changing our attitudes.

The most popular obviously signal on changing attitudes is when you visit with schoolchildren and they tell you I want you to know that the gas prices are too high. I imagine as they are being car-pooled, somebody behind the wheel is complaining about gasoline prices, and I am interested in gasoline prices. So that is how climate change impacts sometimes your constituents, and they are not looking at the whole global issue.

And that brings me to the question of who our partners are, and what are we thinking when we begin to craft not only a message but a mission? Obviously the international Kyoto agreement is not something that we found bipartisanship in. I happen to have been an enthusiastic supporter but I now know that it has aged, and it has aged and aging, and so it may not even be the current format.

I do not know. I am very interested in this theory of cap-and-trade as it relates to emissions. I think it is a thoughtful process but I am concerned because there are many of our communities where the energy industry is an engine of the economy. It is a culture, and certainly the Gulf region that is our culture. Houston is proud. My colleague comes from Houston. He serves ably on Energy Commerce. He knows his work. Has proudly tried to balance and to represent that engine of the economy.

We are concerned if we are losing the battle on educating geologists so that these skills are not lost. We know what happened dur-

ing Katrina when the whole industry was shut down, and we wanted to find a way not only to restore it but to make sure it came back what is ecologically and environmentally sure and safe. So if I could ask the witnesses as they incorporate the concept of what they think of cap-and-trade but who are our partners?

I am concerned that as we speak our major energy companies are continuing to load up in profit but really think that we are enemies when we begin to talk about the global climate change, and they have many friends here. I happen to come from Houston. My colleagues come from Houston and the Gulf region. We want to have a package that works.

So can you just take that broad base? How do we get our energy barons to be partners, and what do you think of this message of cap-and-trade, and this whole idea of our partnerships, and who are they?

Ms. CLAUSSEN. Maybe I can be very brief. At the Pew Center we work with 43 companies, including lots of energy companies.

Ms. JACKSON LEE. Good.

Ms. CLAUSSEN. We agree as a group that cap-and-trade is the most rational approach to dealing with this problem. I can also say that we are a founding member of the U.S. Climate Action Partnership, which is now 26 organizations of which six are NGOs, 20 are companies. You will find that there are oil companies and energy companies that are a part of that as well. Not only do they support cap-and-trade, but they have a very specific proposal for what the targets and time tables should be. So you would be surprised to learn that there is actually a huge interest in the private sector in cap-and-trade, and there are many, many supporters there.

Ms. JACKSON LEE. Doctor.

Mr. JHIRAD. I did not want to sound repetitive but my organization is also involved with these 20 plus companies, and we work a lot with a large number of others who are not part of the U.S. Climate Action Partnership but who have begun to factor in cap-and-trade as part of their corporate strategy. It is clear to me that there are energy companies involved. There is Duke Power. There is General Electric on the power side. But also on the hydrocarbon side there is BP and Chevron, Texaco have joined U.S. Climate Action Partnership and actively supported a phased program. And ConocoPhillips, not Chevron, Texaco. I just had dinner with someone from Chevron, Texaco last night.

Ms. JACKSON LEE. That is all right. We want the record to be clear. The more that you mention the happier I am going to be but let us be clear.

Mr. JHIRAD. But anyway the point is that they actively embrace a thoughtful, careful phased program of cap-and-trade that avoids some of the areas that are quite possible.

Ms. JACKSON LEE. And they can be an effective partner or they believe they are partners in this?

Mr. JHIRAD. They are a very effective partner for us, and for the Congress.

Ms. JACKSON LEE. Dr. Montgomery?

Mr. MONTGOMERY. I am not going to speak for industries but for the results of some of our analysis which suggests that a comprehensive and uniform approach to climate policy, whether it be

a cap-and-trade system or a uniform carbon tax across the whole economy, produces results that I think are much more palatable to industry, if they think about it carefully, than the results of regulatory interventions, subsidy programs, and mandates.

For example, when we analyze the consequences for the next 20 years of a uniform cap-and-trade system, we see relatively small impacts on the petroleum sector. That is because cost effective changes in transportation technology in motor vehicles take a very long time, and petroleum is in fact a very efficient fuel for powering our transportation system. So I think that that is just something to keep in mind. That taking a dispassionate view of how a cap-and-trade system might work sometimes produces some surprises about what the impacts on industry are going to be.

I think also that again going back to the notion of developing the technologies in R&D, I think that most of the energy industry and certainly the people I talked to in the oil and gas industry are very concerned about our technology base, about the availability of the engineers and scientists to create the technologies we need. My son is a geophysicist, though he lives in Denver I am afraid, and so I think about that area too as being something where I think there is a great deal of potential consensus on what can be done.

But the main point would be if you look at something like the Sanders-Boxer bill, the Sanders-Boxer bill has in addition to a cap-and-trade system some very specific regulatory requirements for fuel economy standards and others provisions. They may actually turn out to have much bigger impacts on industry than you would see with a plain vanilla cap-and-trade or carbon tax approach.

Ms. JACKSON LEE. I thank you. Mr. Chairman, I just wanted to make this closing remark. I hope that we will also include in the partnership some of the particularly unique—I call them peculiar institutions—historically black colleges, Hispanic serving colleges, institutions that are in inner city areas. Many of them are broaching or trying to reach out to solar energy alternative research even in these institutions, and they are good messengers for communities that are negatively impacted by either high gas prices, air pollution and other indicia that have to do with climate change.

Mr. GREEN. Thank you.

Ms. JACKSON LEE. I yield back. Thank you.

Mr. GREEN. The chair recognizes Congressman Manzullo.

Mr. MANZULLO. Thank you, Chairman. I just have a couple of observations. First of all, I think we spend a lot of unnecessary time and energy trying to center the argument in terms of global warming as opposed to global pollution.

Everybody agrees there is global pollution but not everybody agrees that global pollution leads to global warming, and so the emphasis should be based upon what do we do to try to lessen global pollution, and let people make their own determination as to the impact of that pollution? You take a look at rivers, and it is obvious when there is a watermelon rind going down that it is unsightly, and somewhere down the line it is going to harm somebody. The second thing is, Dr. Jhirad, can I ask you a personal question? What kind of car do you drive?

Mr. JHIRAD. What kind of a car do I drive?

Mr. MANZULLO. Yes. What kind of automobile do you drive?

Mr. JHIRAD. I drive a Toyota Corolla.

Mr. MANZULLO. Could you—

Mr. JHIRAD. Sorry. I drive a Toyota Corolla.

Mr. MANZULLO. You do not have an SUV in your garage?

Mr. JHIRAD. No.

Mr. MANZULLO. Okay. And how far do you live from work?

Mr. JHIRAD. I live about 10 miles from work and I drive to work every day.

Mr. MANZULLO. All right. Let me give you a situation that I really want you to take into consideration. I think it is really—I want to find the correct words because you are a guest here and everything—I have a rural area. My constituents drive to work not just for the hell of it, because they have to, and for the theorists out there and the philosophers to say all we have to do is just increase the tax on gasoline and people will drive less, do not use that in my congressional district. That insults 700,000 people who must drive as a matter of necessity, unless you want them all to move to the city.

There are about 10 areas like Washington, DC, there is so much pollution around here, there is so much congestion, but that is the only way that they are going to be near public transportation in order to get to work but for the people that live in Galena and Warren and Polo and Mt. Morris and Foreston and who love the country way of life, who want to see their kids grow up in the country, who do not want to be anywhere near the big cities, who appreciate the fact that not everybody should live in a city, that automobile is like their legs.

And to have the people say, just tax gas more so we use less, I would suggest that people with that argument walk to work or take a bicycle to work because that does not bring any type of harmony or that does not add anything to the solution at least for the people in my congressional district. I am just giving you that in the for-what-it-is-worth department.

Second of all on the unilateral controls, somebody at EXIM in 1990 really screwed up America's opportunity to sell hundreds of millions of dollars worth of equipment to the three gorges dam projects, and Senator Simon and I begged the administration at that time, what a stupid requirement to have an environmental sanction against companies that wanted to sell to the three gorges dam project when those companies who sold there were chosen from around the world, regardless of the impact that went on there.

Caterpillar alone lost \$300 million, and you can go from company-to-company-to-company-to-company, and in the proposed legislation that we are going to markup next week, at least somebody withdrew the words mandatory. It talks about OPEC and some more requirements that are necessary before we do it.

The third thing is the employee commute option. Great idea. Back in 1990, with the 1990 Clean Air Act, force people to use public transportation. Well one of my counties, McHenry County, is right on top of Cook County. No public transportation. Essentially a rural area. It has now grown up.

The law was so stupid that schoolteachers were mandated to car-pool in order to go to school but students were not mandated, and

perhaps the schoolteachers could sit there with their thumb out wanting to hitchhike a ride to school while the students were exempt. We eventually worked with Congressman Waxman to change the law to have for the maximum flexibility but when we have these mandates such as taxing the gas or even the carbon trading system, I spend most of my time in Congress working on manufacturing issues, but one of the finest fastener manufacturers in Spain and one of the cleanest environmentally is almost knocked out of business because Morocco is not covered by the carbon trading system, and they are bringing all the fasteners right across the Straits of Gibraltar from Morocco over to Spain.

And so when we do these thing unilaterally, it does not really make that much difference. It helps but it does not make that much difference. Now if you want to respond to that, that is fine. I see my time has run out but it is up to the chair whatever you want to do. If you want to respond?

Mr. GREEN. If each of you could be very brief in your response.

Mr. MANZULLO. And it was not personal. Just a good opportunity to take a jab at a system.

Mr. GREEN. Just a comment from the chair. I notice you did not mention that subsidy for ethanol that Illinois benefits from.

Mr. MANZULLO. Well I mean even still I raise beef cattle you know. People say, "Oh my gosh, the cattle emissions in the atmosphere." I would like to see somebody come up with a solution for that one.

Mr. GREEN. We can sequester that methane.

Mr. MANZULLO. That is correct. Well we have methane digesters but we cannot sell to the grids. There is a problem there. Dr. Jhirad, you have been great.

Mr. JHIRAD. Well I certainly appreciate your very blunt discussion of your constituents and their dependence on driving to work, and I think that is an issue for a lot of people, and so I do not propose to sit in Washington and try to find ways to make life harder. In fact, our approach is to make life easier for a whole group of people who do not live in the beltway.

But the point I was just going to make is that clearly—and this gets into a lot of policy analysis stuff and I do not want to go into that detail—but that clearly if one is going to tax something like carbon or gasoline that there have to be some measures to make it progressive so that it is not regressive to people under a certain income level who will feel the pinch, and I think that some of the analysis we have done show that you cannot just do it by itself.

You have got to have some measures to protect those who do not have the income or rely on their cars and rely on gasoline so that this does not affect them disproportionately. So I think that is an issue, and I think it is an issue that we should deal with. I will stop right there because this is a long discussion. Maybe we should have it outside the hearing.

Mr. MANZULLO. I would love to. Thank you for your graciousness.

Mr. GREEN. Well, Dr. Montgomery?

Mr. MONTGOMERY. If I could just inject very quickly. I think there is a question of whether something will be done about climate change. So let us assume that Congress does something. Then

I think there are choices going to be made that are going to be better or worse for your constituents.

I would suggest that your constituents would be a lot better off with a gasoline tax that at least allowed them to choose whether they were going to drive more because it does allow freedom of choice. They can choose to drive more. Someone in the city can choose to drive less. As opposed to Congress deciding to impose a fuel economy standard that says, they just flat cannot buy a pickup truck that is big enough to pull anything worthwhile or they have to carpool to go all those places that nobody else is going.

So it is a question of the lesser of the evils there, and I would argue that there is a lot to be said for the tax approach being the lesser of those evils, even for someone in the position of your constituents.

Mr. DELAHUNT. Mr. Chairman?

Mr. GREEN. Yes.

Mr. DELAHUNT. If I can just yield me 1 minute.

Mr. GREEN. Sure.

Mr. DELAHUNT. In response to my good friend from Illinois and following up on your observation about ethanol, and I want to be clear I am not supporting a tax. I do not think that is the right way to go. However, I would presume that if we invested what we ought to invest in terms of R&D as far as cellulosic ethanol for example so that it became widespread so that the market was—for example in Brazil, there is not a car that is being produced today, it is my understanding, that is not a flex fuel vehicle.

That we have done something about our energy security, and at the same time while it is not a silver bullet in terms of diminishing CO₂ emissions, I hear it ranges from 20–30 percent in terms of a diminution. So it is a question of really how do we proceed? But I guess my question because this is the Committee on Foreign Affairs, how do we take advantage of our foreign assistance as well as whether it is through OPEC, the U.S. Trade Authority or whatever, to incentivize particularly developing countries, and maybe we work in conjunction with the developed countries, whether it is the EU or others, that would encourage them to do something significant or to accelerate their willingness to deal with CO₂ emissions?

Ms. CLAUSSEN. Can I just respond briefly here? I would like to come into your office and talk about how we can deal with this problem in ways that work for you and your constituents.

Mr. MANZULLO. I would be delighted. I am thrilled really after the way I beat you guys up here. Thank you.

Mr. GREEN. Any other comments? Thank you again for being here, and the committee is adjourned.

[Whereupon, at 12:20 p.m., the committee was adjourned.]

A P P E N D I X

MATERIAL SUBMITTED FOR THE HEARING RECORD

PREPARED STATEMENT OF THE HONORABLE SHEILA JACKSON LEE, A REPRESENTATIVE
IN CONGRESS FROM THE STATE OF TEXAS

Thank you, Chairman Lantos, for convening today's hearing and focusing the attention of this committee on what I believe is an extremely critical issue. Scientific consensus has firmly established that global warming is a fact; it has been observed and documented, and now we must work together as a Congress, a nation, and an international community to confront this reality. May I also thank the Ranking Member, and welcome our three distinguished witnesses: the Honorable Eileen Clausen, President of the Pew Center on Global Climate Change; Dr. David John Jhirad, Vice President for Science and Research at the World Resources Institute; and Dr. W. David Montgomery, Vice President of CRA International. I look forward to hearing your insightful testimony.

Over the past several decades, scientists have documented increases in global temperature, rising sea levels, and melting ice sheets and glaciers. A strong scientific consensus exists that the Earth has warmed about 1.5 degrees Fahrenheit since the Industrial Revolution, largely due to human influence. The heavy industrialization of the west has led to increased greenhouse gas concentrations, as well as to the destruction of a number of natural habitats.

The United States has a particular responsibility to be a leader in any attempt to address global warming; as a nation, we currently contribute about 1/5 of net global greenhouse gas emissions. If human activities are even partially responsible for damaging this planet we call home, then human agencies, such as this Congress, must seek to provide the solutions.

Today, we are here specifically to examine American re-engagement in global efforts to fight the catastrophic effects of climate change. While national policies are a crucial aspect of any effort to fight climate change, global warming is, as its name implies, truly a *global* problem, in need of a *global* solution. And yet, in recent years, the United States has declined to participate in some of the major initiatives of the international community.

Currently, the only legally-binding international instrument requiring the reduction in greenhouse gas emissions is the Kyoto Protocol, signed in 1997 but rejected by the Bush administration 2001. Even if Kyoto is fully subscribed to and implemented, it was only ever intended to be a first step. Because of the economic implications of aggressively addressing global warming, it is absolutely imperative that the industrialized and developed nations work together to take the lead in this process.

Mr. Chairman, energy consumption is closely related to climate change. 85% of U.S. greenhouse gas emissions come from energy-related activities, as do 96% of our nation's carbon dioxide emissions. My district in Houston is home to many leading energy companies, and I remain concerned about the ability of these companies to compete in a global marketplace if the United States fails to act in conjunction with other developed nations. Many of the major oil companies have already put significant effort into developing alternative fuel sources; I support responsible efforts to investigate renewable energy alternatives. Here in Congress, we must seek policy options that will allow the United States to continue to flourish without destroying the world around us. The environment is a key resource to ensure future prosperity.

There is still a great deal that we don't fully comprehend about global warming. Scientists are predicting further increases in global temperature during the 21st century, with estimates ranging from as low as 2.7) Fahrenheit to the frighteningly high figure of 9) Fahrenheit. Further research remains an important component of any effort to address this phenomenon. As a member of Congress, I have long been

a strong supporter of increased funding for energy research. Fossil fuels have been of great importance in our development and continue to be extremely valuable, but a new century brings with it new energy requirements. We must continue to invest in research into alternative and renewable sources of energy.

Mr. Chairman, the Earth's climate is changing. This is a well-documented, though not yet entirely understood fact. The congressional debate is no longer *if* this change is occurring, but rather *how* it is happening and what we can do to stop or slow it. The environment is our most valuable asset; it is the most precious legacy we have to pass on to our children. I thank the Chairman for bringing this committee together to address this very important issue, and I look forward to hearing the testimony of our witnesses and engaging in constructive debate with my colleagues.

Thank you, Mr. Chairman, and I yield back the balance of my time.

PREPARED STATEMENT OF THE HONORABLE DONALD A. MANZULLO, A
REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Thank you, Mr. Chairman, for holding this important hearing on climate change today. I also welcome the witnesses and look forward to their testimony. International environmental issues are of significant concern to all Americans, and I am pleased to participate in this first committee hearing on this topic today.

Let me begin by saying that the current debate over climate change often misses the mark on the real problem. What we should discuss are the effects and consequences of pollution on our environment and not have an endless debate as to whether or not global warming is taking place. No one supports polluting the environment. We should be working on common ways to fighting global pollution that also includes the emerging economies of the world such as China, India, and Brazil. The one key weakness in the Kyoto Protocol—and the main reason why the Senate voted unanimously against implementation in 1997—was that the rapidly growing economies of the developing world are exempt from the agreement.

Mr. Chairman, I am concerned that the proposed "International Climate Change Re-Engagement Act," which was circulated late last week as a draft, will not receive the benefit of a subcommittee review. The proposed legislation contains sweeping provisions that require greater attention than a single hearing can provide. I am very concerned that the proposed legislation may negatively affect our nation's manufacturers. It also increases spending and expands the size and scope of the federal government. For example, the proposed bill creates a new Office of Global Climate Change in the State Department that largely duplicates the work of the Bureau of Oceans and International Environmental and Scientific Affairs. Furthermore, the Act proposes an entirely new government body, called the International Clean Energy Foundation, with a \$20 million authorization, to promote the policies outlined in this draft. Finally, I wish point out that the Executive Branch is not even present at today's hearing to address the proposed changes being made. So, we must take every effort to deliberately and methodically review this proposed legislation. We all want to work towards reducing global pollution but I find it difficult to believe that creating new governmental structures and higher spending will necessarily translate into producing the solutions we all seek.

There is a subcommittee within the Foreign Affairs Committee that is responsible for global environment issues. I hope you will give the Members of the Subcommittee on Asia, the Pacific, and Global Environment an opportunity to hold a hearing and report out the Re-Engagement Act prior to a full Committee mark up.

WRITTEN RESPONSES FROM DAVID JOHN JHIRAD, PH.D., VICE PRESIDENT FOR SCIENCE AND RESEARCH, WORLD RESOURCES INSTITUTE, TO QUESTIONS SUBMITTED FOR THE RECORD BY THE HONORABLE DANA ROHRBACHER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Question:

Please comment on the possibility of carbon sequestration in aquifers causing their acidification and ultimately significantly contributing to the acidification of the oceans to which these aquifers are connected.

Response:

This is a manageable problem if the carbon sequestration is properly sited and operated.

When carbon dioxide is injected into deep underground "saline aquifers", much of the gas will dissolve into the fluid. Carbonic acid is a product of this reaction. This acidification should not result in unmanageable risks, however, if the sequestration

project is properly sited, operated and monitored. Fluids in saline aquifers are, by definition, not sources of drinking water, nor should the acidified liquids migrate to other sources of drinking water if conducted properly. Carbon dioxide and any associated reactants are designed to stay confined in targeted underground reservoirs through a combination of primary (reservoir seals) and secondary (dissolution, capillary action, and mineralization) trapping mechanisms. A recent field study found that acidified fluids can liberate heavy metals within the reservoir, as expected, but that these potential dangerous elements should remain trapped in any project that is carried out according to accepted criteria. (Measuring permanence of CO₂ storage in saline formations: the Frio experiment, S. Havorka, et. al., *Environmental Geosciences*, June 2006, v. 13, no. 2, pp. 105–121)

Question:

If we accept the premise of global warming, don't we have to reduce emissions to zero to keep the amount of greenhouse gases in the atmosphere constant? And cause a net negative emission (via ocean uptake or some other active mechanism) along with zero or near-zero emissions to reduce these gases?

Response:

Mitigating climate change, and keeping the amount of greenhouse gases (GHGs) in the atmosphere constant, does not mean reducing emissions to zero, since there is a natural rate of uptake of greenhouse gases by the land surface and oceans. One has to reduce the rate of emissions to the natural rate of uptake or absorption to keep the atmospheric concentration at a constant level.

The greenhouse effect keeps the earth around 30° warmer than it would be without the presence of greenhouse gases. Otherwise, the Earth would be extremely cold. GHGs such as carbon dioxide, methane, but mostly water vapor, act like a blanket around the earth, trapping heat and keeping the temperature at these elevated levels.

Exponential increases in the concentrations of GHGs in the atmosphere, however, means that more heat is trapped and global temperatures increase, which is our current reality.

Therefore, the current level of human-induced GHG emissions need to be reduced significantly to stabilize GHG concentrations. The extent of GHG emissions reductions is subject to debate. To avoid the worst effects, emissions of these gases will have to be reduced by about 60 to 80 percent below business-as-usual by 2050, in order to keep atmospheric concentrations in the range of 450–550 ppm (IPCC). The current level is around 380 ppm and rising at more than 2 ppm per year).

Summary:

- Aim: Stabilization of atmospheric carbon dioxide concentrations in the atmosphere should not exceed 450 to 500 ppm¹.
- How? Stopping CO₂ emissions from rising further, and achieving a world wide long-term decline within the next decade. Recommended decline is 60 to 80% below current levels by 2050.

Even if greenhouse gas concentrations were stabilized, the GHGs that are already in the atmosphere because of human activity will continue to warm the planet for the rest of the century². The heat that is already stored in the ocean could add an additional 1 degree Fahrenheit of warming by the end of the twenty-first century. Some level of continued climate change is inevitable, meaning that humanity will have to implement adaptation as well as mitigation strategies.

Question:

How does one go about reducing greenhouse gas emissions?

Response:

Significant reductions in GHG emissions will require a transformation in the global energy system through a combination of short-term and long-term commitments at a national and international level.

Princeton researchers Robert Socolow and Stephen Pacala have suggested that one way to think about the problem of reducing GHG emissions is to break the necessary reduction into 7 wedges. Each wedge represents a strategy that can reduce carbon emissions by 1 billion tons per year within 50 years. WRI is building on this

¹ <http://pdf.wri.org/070516—lash—testimony.pdf>

² For more information: Working Group III of IPCC AR4 from the IPCC

work to look at potential opportunities for emission reductions through the scaling up of technological solutions³ (see Figure 1).

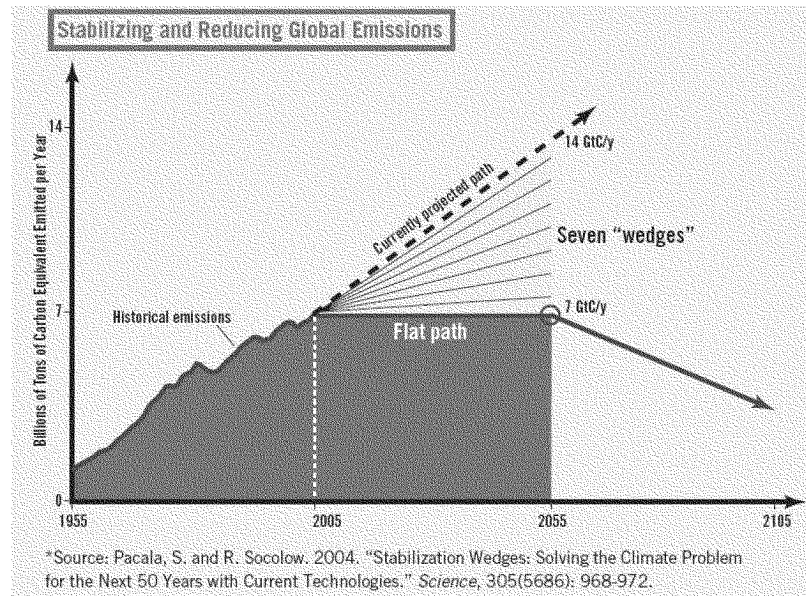


Figure 1

WRITTEN RESPONSE FROM W. DAVID MONTGOMERY, PH.D., VICE PRESIDENT, CRA INTERNATIONAL, TO QUESTION SUBMITTED FOR THE RECORD BY THE HONORABLE DANA ROHRBACHER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Question:

In order to take advantage of profiting on cap and trade offsets, some organizations may provide demonstrations of ideas that are ineffective or even detrimental to the environment in the long run. Who will decide whether a proposed offset will be considered legitimate?

Unlike commodity trading (real goods in a supply and demand marketplace) cap and trade is an entirely man-made artificial market subject to man-made tampering. How do you propose to eliminate this possibility?

Response:

Offsets are included in climate legislation for the laudable aims of providing 1. lower cost methods of compliance for firms that would face high costs under a cap and trade system, and 2. incentives for emission reductions in areas not covered by cap and trade. Unfortunately, as the experience of the CDM shows, there is an inherent flaw in an offset program. The amount of offsets is calculated as the difference between a hypothetical "baseline" of what emissions would have been absent the qualifying action and actual emissions. This calculation of baseline is inherently subject to gaming and can provide perverse incentives that lead to increases in emissions in order to qualify for the gains from selling offsets.

Some agency of government must set the rules for how offsets are measured. This leads to a conflict between the two laudable objectives. If rules are strict, then many projects that would lead to real emission reductions will be disqualified. If they are lax, then many projects that do nothing or cause additional emissions will slip through. There is no way to avoid this when a hypothetical baseline must be constructed.

³ For more information: <http://www.wri.org/climate/pubs—description.cfm?pid=4292>

There are real risks of other kinds of tampering with the artificial carbon market. Since high carbon prices directly cause high electricity prices, as we have seen in Europe, there may be incentives for a classic “squeeze” on a carbon market in order to drive up the value of positions in energy futures. The more complex a carbon market is made, the more likely it is that someone will find a way to play such tricks.

The most straightforward way to avoid this tampering is to use a carbon tax as the primary policy instrument rather than cap and trade. Then the actions that generate offsets can either be subjected to the same tax, or if the actions are as simple as process changes to eliminate HCFCs, they could be required by technology standards. Substitution of technology standards for unnecessarily generous offset credits has indeed been proposed as a means of eliminating the gaming now found in the CDM program. Adding a safety valve that prevented spikes in the price of carbon under a cap and trade system would also eliminate much of the possibility for gaming or manipulation of a carbon market.

QUESTION SUBMITTED FOR THE RECORD TO THE HONORABLE EILEEN CLAUSSEN, PRESIDENT, PEW CENTER ON GLOBAL CLIMATE CHANGE, BY THE HONORABLE DANA ROHRBACHER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Question:

Please comment on the possibility of carbon sequestration in aquifers causing their acidification and ultimately significantly contributing to the acidification of the oceans to which these aquifers are connected.

In order to take advantage of profiting on cap and trade offsets, some organizations may provide demonstrations of ideas that are ineffective or even detrimental to the environment in the long run. Who will decide whether a proposed offset will be considered legitimate?

Unlike commodity trading (real goods in a supply and demand marketplace) cap and trade is an entirely man-made artificial market subject to man-made tampering.

How do you propose to eliminate this possibility?

Response:

NOTE: As of press time, no response was received by the committee.

